RECIPROCAL IMPACTS OF BLACK RHINO AND COMMUNITY-BASED ECOTOURISM IN NORTH-WEST NAMIBIA

by
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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: December 2010

ABSTRACT

This research focuses on the black rhinoceros and ecotourism in three conservation areas in the Kunene region of Namibia. The reciprocal impact between black rhino and community-based ecotourism is analysed. The research is located in two communal conservancies, #Khoadi-//Hôas and Torra, and in a photographic tourism concession, the Palmwag Concession Area.

The research aims to explore and describe the reciprocal impact of community-based ecotourism efforts and black rhino spatial movement patterns in three conservation areas in north-west Namibia. An in-depth literature review was undertaken on the reciprocal impact between rhino-tracking tourism and conservation. A comparison was also made between the effects of human-induced disturbance on spatial movement patterns of black rhinos and the perception of tourists about tracking black rhinos. The value of black rhinos to community-based ecotourism was also determined.

Quantitative research methodology was used for this study. Explorations of objectives were conducted through direct field observation with the aid of radio-telemetry tracking and aerial surveying for data gathering. The researcher employed SRT (Save the Rhino Trust) trackers in the study areas to assist with the tracking. The sample consisted of 24 transmitter-fitted black rhino in the three conservation areas. Rhino not fitted with transmitters have been included in the sample for more accurate results. Four hundred questionnaires were distributed at four tourist lodges in the study area.

The hypothesis that sustainable ecotourism does not influence black rhino spatial behaviour was rejected. Rhinos in the study were easily disturbed and did not readily return to undisturbed behaviour. Their major response to disturbance was to run away. The disturbance was influenced by their initial activity when found. The highest disturbance occurred early in observations. Rhinos illustrated similar causes of disturbance throughout the study sites. The Springbok River emerged as the area with the most severe reactions to disturbance. This was supported by home range data and

ecological constraints. Analysis of tourist responses regarding rhino tracking indicated a high demand for and level of satisfaction. This was the single determining factor for tourists to return to the Kunene region to do rhino tracking again. Tourists were willing to pay close to market price to track black rhino.

It is recommended that tracking of black rhino should be avoided in the Springbok River and Aub/Barab areas. Tracking protocols should stipulate that tracking should only be conducted early in the morning; that rhinos may only be approached from downwind; that observation time may not exceed 15 minutes; that groups must be kept small; and that the approach distance may not be less than 100 metres.

OPSOMMING

Die fokus van die navorsing is op swart renosters en ekotoerisme in drie bewaringsgebiede in die Kunene streek van Namibia. Die wedersydse wisselwerking tussen swart renosters en gemeenskaps-gebaseerde ekotoerisme is nagevors. Die navorsing het plaasgevind in twee kommunale bewaringsgebiede, #Khoadi-//Hôas en Torra asook ‘n konsessie vir fotografie in die Palmwag Konsessie Gebied.

Die doel van die navorsing was om die wedersydse wisselwerking van gemeenskaps-gebaseerde ekotoerisme en swart renosters se geografiese bewegingspatrone in drie bewaringsareas in noordwes Namibië te ondersoek en te omskryf. ‘n Deeglike literatuurstudie is gedoen ten opsigte van die wedersydse wisselwerking tussen toerisme met die doel om renosters waar te neem deur spoorsny en bewaring van die spesies. Die uitwerking van versteuring deur mense op die geografiese bewegingspatrone van swart renosters is vergelyk met die persepsie van toeriste ten opsigte van spoorsny van swart renosters. Die waarde van swart renosters ten opsigte van ekotoerisme is ook bepaal.

Kwantitatiewe navorsingsmetodologie is gebruik in die studie. Die doelstelling van die navorsing is uitgevoer deur direkte veld waarnemings met behulp van radio-telemetriese opsporing en data insameling met behulp van lugsensusse. Die navorser het spoorsnyers van SRT (Save the Rhino Trust), wat in die studiegebied werk, in diens geneem om van hulp te wees met die spoorsny van renosters. Die steekproef het bestaan uit 24 swart renosters toegerus met seintoestelle in drie bewaringsgebiede. Renosters wat nie seintoestelle gehad het nie, is ook in die steekproef ingesluit ten einde beter dekking te verkry. Vierhonderd vraelyste is by vier toeristeoorde in die studiegebied versprei.

Die hipotese dat volhoubare ekotoerisme nie ‘n invloed uitoefen op die geografiese gedrag van swart renosters nie, is verwerp. Renosters in die studie-gebied is maklik versteur en het nie geredelik teruggekeer tot onversteurde gedrag nie. Hulle reaksie op versteuring was gekenmerk deur weg te hardloop. Die mate van versteuring is bepaal

deur die renosters se aanvanklike aktiwiteit by opsporing. Die meeste versteuring het gedurende vroeë waarneming plaasgevind. Dieselfde oorsake van versteuring is in al drie gebiede gevind.

Die Springbokrivier was die gebied waar die sterkste reaksies ten opsigte van versteuring bespeur is. Dit word ondersteun deur die grootte van die loopgebiede van die renosters en ekologiese beperkings van die gebied. Data-analise van toeriste-vraelyste het aangetoon dat daar ‘n groot aanvraag en belangstelling is in die spoorsny van renosters. Die grootste bepalende faktor vir toeriste om na die Kunene streek terug te keer, is om renosters te sien deur middel van spoorsny. Toeriste is gewillig om die heersende markprys vir spoorsny van renosters te betaal.

Navorsingsaanbevelings sluit in dat spoorsny van swart renosters in die Springbokrivier en Aub/Barab gebiede vermy word. Spoorsny-protokol moet stipuleer dat dit net in die vroeë oggend gedoen word, dat renosters slegs van onderkant die wind genader word, waarnemingstyd mag nie 15 minute oorskry nie, groepe moet klein wees en die afstand vanaf die diere mag nie nader as 100 meter wees nie.

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Finally, to the Almighty God for the assurance: “I can do all things through Christ who strengthens me” (Philippians 4: 13)

Dedicated to the memory of my grandmother

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ACRONYMS

AfRSG	African Rhino Specialist Group
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBNRM	Community-Based Natural Resource Management Programme
CITES	Convention of International Trade in Endangered Species of Wild Fauna and Flora
CONINFO	Central CBNRM Computer Database
ECC	Ecological carrying capacity
EU	European Union
GIS	Geographic information system
GPS	Global positioning system
HID	Human-induced disturbance
ICEMA	Integrated Community-based Management Projects
IUCN	International Union for Conservation of Nature
MCP	Minimum convex polygon
MET	Ministry of Environment and Tourism
NGO	Non-governmental organisation
SADC	Southern African Development Community
SRT	Save the Rhino Trust
UNDP	United Nations Development Programme
WPS	Wildlife protection services
WWF	World Wide Fund for Nature

CHAPTER 1: INTRODUCTION

"Every country can be said to have three forms of wealth: material, cultural and biological. The first two we understand very well, because they are the substance of our everyday lives. Biological wealth is taken much less seriously. This will be a strategic error, one that will be increasingly regretted as time passes."

(*Edward O. Wilson, scientist, Nobel Prize winner and author of* The Diversity of Life, 1992*)*

1.1 Rationale for study

The black rhino is one of the most endangered species of the so-called Big Five (lion, elephant, rhino, buffalo and leopard). The International Union for Conservation of Nature's (IUCN) Red List of Threatened Animals (IUCN 2009)[1] regards it as critically endangered and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) categorises the species as Appendix 1 (UNEP-WCMC 2005). Black rhino numbers have declined by over 80% over the last 45 years according to direct observations (Du Preez 2000). Poachers provide and sell black rhino horns to cultures which have a firm belief that they have aphrodisiac and medicinal effects and this, amongst other uses, contributes greatly to the decline in numbers. Conservation is the only way to prevent the decline of the species. Conservation, however, is costly and a means of income generation is, therefore, needed to conserve the black rhino.

The black rhino is the pinnacle of the large and endangered species in Namibia, and is of great economic and ecological importance, not only for Namibia but also for the African continent at large (Du Preez 2000). Tourism could be a good alternative to poaching and to generate additional income and to contribute substantially to the conservation of this

[1] Although the species is listed as Critically Endangered, the Namibian subspecies *Diceros bicornis bicornis* is listed as Vulnerable.

species (Ramutsindela 2004). The Big Five and especially the black rhino are generally regarded as big tourist attractions which could be used for generating additional income. International tourists are willing to pay a substantial amount of money to view black rhinos (Loon 2004).

Almost one third of the total world population of black rhinos in Africa is located in Namibia and this includes 95% of the total world population of the sub-species *Diceros bicornis bicornis* (Namibia 2003b). The Kunene region has a black rhino population that contributes to Namibia's success in black rhino conservation. These animals are located on communal land and the population was estimated at 142 animals in 2003. The rhino population occurs in an area of approximately 70 000 km², in the north-west of Namibia and is perceived as a Key 1[2] population (Emslie & Brooks 1999; Hearn 2003). The extreme aridity of the area contributes to this status. The range mainly covers uninhabited, arid country between the Skeleton Coast Park and communal farming areas to the east.

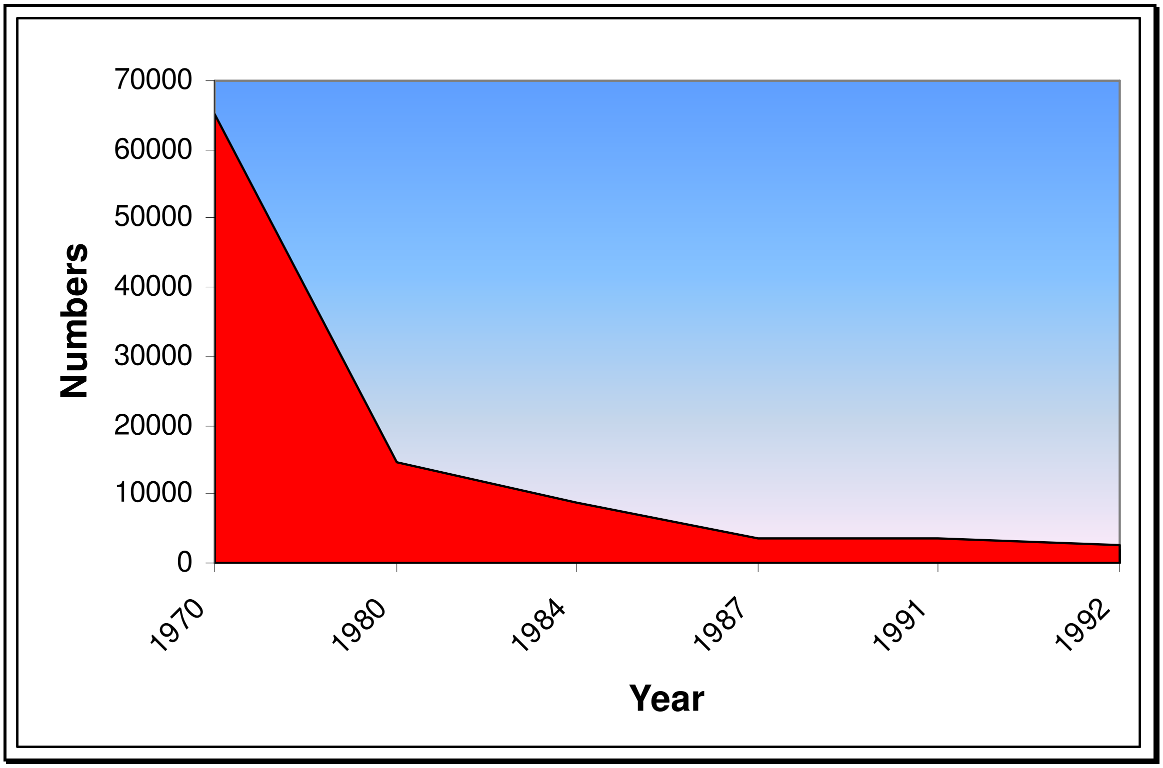
Although ecotourism contributes to income generation and there is evidence that it has been influential in the successful conservation of the black rhino population in the Kunene region over the last ten years, the impact through human-induced disturbance (HID) on the spatial movement patterns of black rhinos needs to be evaluated. The value of the endangered black rhino must be offset against the degree of disturbance that may be caused by ecotourism. Finally, a compromise between high-value species and ecotourism has to be found.

1.2 Problem statement

The fact that black rhinos are critically endangered could be viewed as the real world problem that prompted this study. Hearn (2003) highlighted this fact, as illustrated in Figure 1.1, by stating that black rhino numbers have dropped from an estimated world-

[2] Rhino population that is increasing or stable and numbering above 100 or more than 50% of the subspecies.

wide population of 65 000 in 1970 to a population of less than 2500 in 1992. Poaching for their horns has been and continues to be the major cause of the decline of black rhino numbers (Slattery 2003). Rhino horn is regarded as an essential ingredient in traditional oriental medicines. It is also used in the manufacture of handles for ceremonial daggers (*jambiyya*) in Yemen where such daggers are a status symbol (‘T Sas-Rolfes 1997).



Source: Emslie & Brooks 1999; Hearn 2003

Figure 1.1: Trends in black rhino populations in Africa, 1970-1992

The development of the tourism industry has put an economic value on wildlife so that the industry has become a fundamental component in the conservation of the Kunene’s wildlife populations and especially black rhino. The Kunene black rhino population serves as a strategic flagship resource both for conservation and for improving livelihoods through ecotourism in communal conservancies in Namibia (Save the Rhino Trust 2005). Tracking black rhinos is an attraction that influences the tourists’ decision to visit the region (Sibalatani 2004). The desert-adapted black rhino and the scenic landscapes of the Kunene do not benefit local communities economically unless rhino tracking safaris are provided. Income generated through tourism could contribute substantially to the conservation of this species but there are drawbacks. Some species are known to be affected by large numbers of tourists. There is still concern that tourism is often promoted without due consideration of long-term conservation objectives for species and their habitats (Hutton & Leader-Williams 2003). The black rhino population in the north-west of Namibia is unique and fragile. Renowned for being the last freehold population in Africa they attract many tourists. The effects ecotourism has on the rhinos need to be analysed. Montgomery (2001) points out that ecotourism has led to direct or indirect trespassing on the natural habitat of the black rhino, especially in the south of their range, where no calves have survived in the last decade. A balance must be kept between satisfying the needs of ecotourists and the needs of the environment and species tourists seek to visit and observe.

This situation calls for questions to be asked about this real-life problem that can be empirically investigated (Mouton 2001). Two hypotheses emerge from the research problem namely:

- Sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos; and
- Tracking of black rhinos contributes beneficially to sustainable community-based ecotourism.

These hypotheses give rise to the aim and objectives of the study.

1.3 Aim and objectives of the research

1.3.1 Overarching aim

This research aims to explore and describe the reciprocal impacts community-based ecotourism efforts and black rhino spatial movement patterns have on one another in three conservation areas in Namibia.

1.3.2 Research objectives

Five objectives were aimed at, namely;

- To review the documented reciprocal impacts between tourism and rhino conservation through an in-depth literature study;
- To explore, describe and compare three conservation areas in north-west Namibia;
- To observe and describe the effects of human-induced disturbance on the spatial movement patterns of black rhinos in the three conservation areas using radio-telemetry tracking and aerial surveys;
- To examine and describe tourist perceptions of tracking black rhinos in the three conservation areas; and finally
- To investigate and describe the probable income-generating benefits of tracking black rhinos (as a high-value species) to promote sustainable community-based tourism.

1.3.3 Population of the study

The elements on which research focus and which contributes to the results, and which should be generalised, are those involving the study of the population. De Vos *et al.*

(2005: 194) state that: “a population is the totality of persons, events, organization units, case records or other sampling units with which the research problem is concerned.” The populations to be studied are empirical in nature and comprise biological organisms and human actions as entities, as well as the interaction between them. The black rhino population of the Kunene region and the tourists visiting the area constitute the ‘population’. Samples from these entities will be studied in an effort to understand the ‘population’ from which they are drawn. Sampling enables the researcher to study a small proportion of a target population, in order to obtain data that are representative of the whole (Sarantakos 2005). An area sampling technique of probability sampling, is guided by the principle that every unit of the target population has an equal, calculable and non-zero probability of being included in the sample.

This procedure uses multi-stage sampling in geographical areas (Sarantakos 2005). The geographical areas are the #Khoadi-//Hôas and Torra Conservancies and the Palmwag Concession Area. The sample of animals in this research represents 24 black rhinos fitted with transmitters (see Appendix A) as well as any other rhinos found in the three areas during fieldwork. Tourists are included, as a sample, to establish their perceptions of rhino tracking in communal conservancies and how this activity contributes to sustainable community-based ecotourism. The interactions between all the studied subjects will be analysed to determine interrelationships and probable consequences.

1.4 Geographical context of the study

The particular intellectual milieu, which includes the disciplinary and institutional contexts, determines the ways researchers operate. The intellectual milieu includes meta-theoretical assumptions within a discipline. The intellectual climate is also characterized by theoretical and methodological resources. Theoretical resources are theories, models, interpretations and research findings that are accepted by the scientific community as valid. Methodological resources include the methods, techniques and approaches used in the research process. However, research also results in diverse scientific outputs which include new data or findings, explanations, models and theories (Mouton 2001). These outputs are disseminated in various forms including publications, presentations and electronic material. Specific stakeholders, which include scientists, potential clients, donors, the general public and government, have an interest in these findings.

The intellectual milieu in this research include the meta-theoretical assumptions in physical and human geography. Physical geography is the study of the earth's surface, which encompasses land, water, air, plants and animals while human geography is the study of the human features of the earth's surface, which includes *inter alia* human population settlements and transportation routes (Barnard 2001). This research involves physical geography by virtue of the spatial phenomena of black rhino behaviour, their home ranges and factors that influence these. Human geography is represented by tourism and human interaction with black rhinos. Geography remains one of the few subjects dedicated to exploring the relations between society and nature (Ramutsindela 2004). According to Rafferty (1999), geographers are interested in the interrelationships of humankind and the environment, and our training in field methods as geographers enables us to study the human role in reshaping the environment, which includes the development of areas for recreation and tourism.

The scientific outputs of this research project will potentially represent new findings about the reciprocal impacts of black rhinos and ecotourism which can be disseminated in a thesis and through presentations. Specific stakeholders, who will hopefully benefit from this research, are scientists in geography, ecotourism and environmental studies. Potential clients, for example tourists, donors, the Ministry of Environment and Tourism (MET) of Namibia and the general public (which includes the indigenous people of specified conservancies) should also benefit. The research boundaries drawn next, give an indication of the milieux in which the research was conducted.

1.5 Research boundaries

The research was conducted in the Kunene region of Namibia. The area is about 70 000 km² in extent. The region is an arid and semi-arid environment with average rainfall varying annually from 100 mm to 300 mm (Long 2001). Livelihoods are primarily based on livestock keeping, gardening and limited employment. There is an estimated population of 70 000 people in the remote north-west of Namibia. Most of the region has a population density of less than one person per km² (Long 2004). The Kunene region is characterized by great scenic beauty and is home to a wide range of wildlife species, including the desert-adapted elephant and black rhino. The location of the three conservation areas in the Kunene region, namely Torra and #Khoadi-//Hôas Conservancies and the Palmwag Concession Area, is shown in Figure 1.2. Each of these conservation areas is discussed in the next three sections.

1.5.1 Torra Conservancy

The Torra Conservancy is situated in the Khorixas constituency in the southern half of the Kunene region, north-west Namibia. It borders the #Khoadi-//Hôas and Doro!Nawas Conservancies to the east and south respectively, the Skeleton Coast Park to the west and the Palmwag Concession Area to the north. The veterinary corridor fence forms its northern boundary. The administrative centre is the village of Bergsig. The Torra Conservancy covers an area 3522 km² and the landscape is characterized by gravel plains and ancient fields of basalt and rugged, rock-capped mountains. The area has excellent natural water supplies and fertile soils, despite the low rainfall of 70 mm to 100 mm in the wet season. The major river systems are the Huab, Koigab and Uniab, all of which have major wetlands and springs.

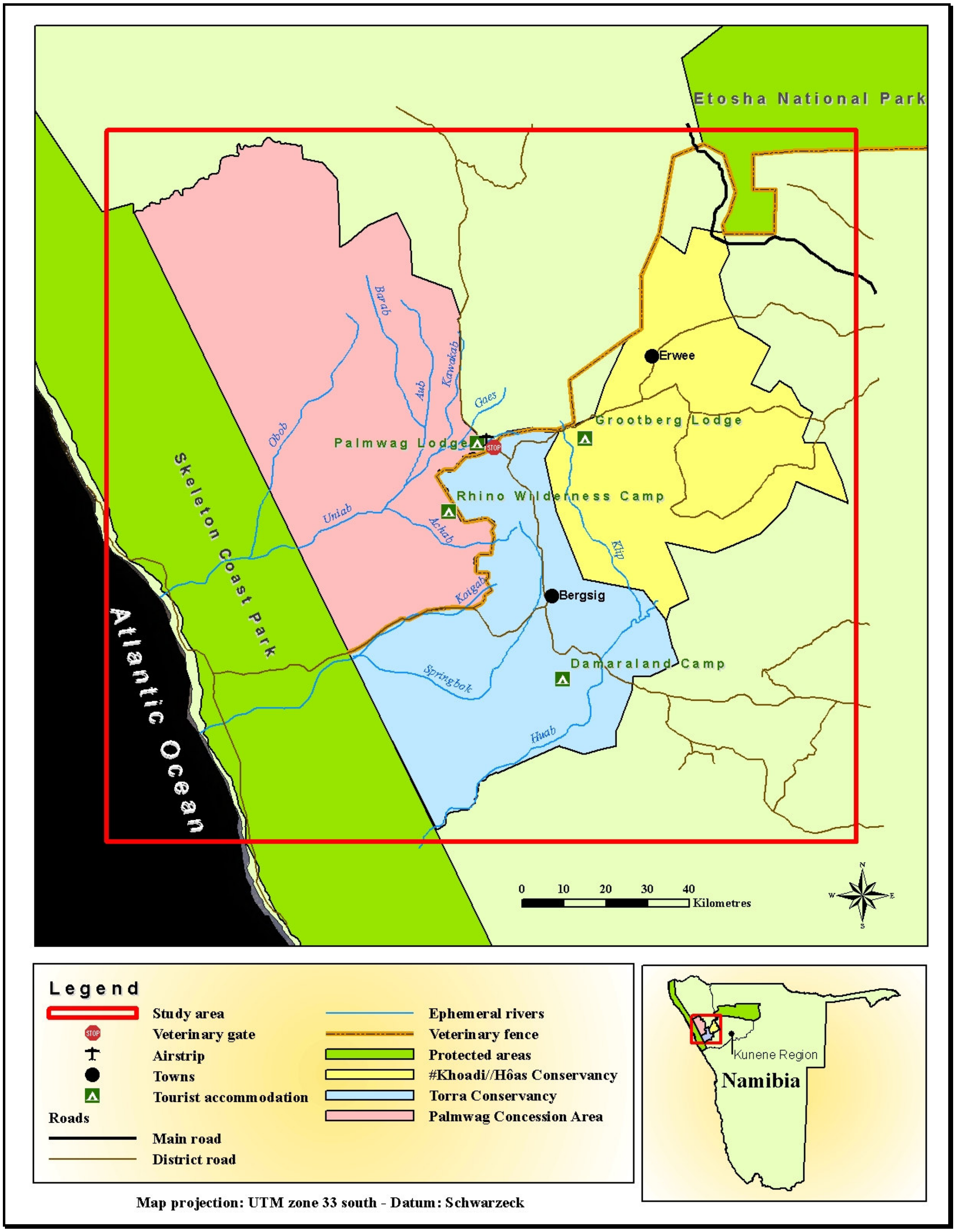


Figure 1.2: The study area

The area is sparsely populated with one person per three km² and an approximate population of 1200, with an estimated 123 households. The population is ethnically mixed with Damaras, a few Herero and Owambo families and some Riemvasmakers. The main livelihood activities are small-stock farming, limited large-stock farming, small-scale vegetable gardening and wage labour, plus contributions from absent wage earners (Long 2001). Torra was one of the first four conservancies to be registered in Namibia and it has a strong membership base. In 2000, Torra became the first of Namibia's conservancies to be financially self-sufficient thanks to two lucrative tourism joint ventures. The annual income for 2002 was N$750 000 (Long 2004). The main enterprises are joint-venture trophy-hunting, a joint-venture lodge with Wilderness Safaris, namely Damaraland Camp, live sales of springbok and own-use hunting. Torra is one of the wealthiest conservancies financially. They earn income from trophy-hunting and joint venture agreements (Long 2001).

1.5.2 #Khoadi-//Hôas Conservancy

#Khoadi-//Hôas means "elephant's corner" in Damara. The #Khoadi-//Hôas Conservancy is situated within the Sesfontein constituency in the southern half of the Kunene region. It borders on the Torra and Ehirovipuka Conservancies to the west and north. To the north-west is the Etendeka Concession Area and to the north-east the Hobatere Concession. Privately-owned commercial farmland forms the eastern boundary. The conservancy administration centre is the Grootberg Breeding Station. The conservancy covers an area of 3366 km². The eastern landscape is characterized by ancient fields of basalt and rugged, rock-capped mountains, including the well-known Grootberg Mountain range. The remainder of the area is characterized by dolomite bolder hills and flat Mopane woodland. The rainfall averages from 100 to 250 mm annually with an east to west rainfall gradient that is highly variable (Vaughan & Katjiua 2002). The Klip River valley in the Grootberg Mountain range has been declared a conservation and tourism area (Jones, Wahome & Araseb 2001).

The area is relatively densely populated with one person per km² and an estimated population of 3200 people and an estimated 640 households (Long 2001). Damara is the dominant ethnic group, with a large number of Herero and Owambo families also present. The main livelihood activity is small-stock farming and small gardens. The aridity of the area limits large-stock farming. Absentee wage earners and pensioners also contribute to the livelihoods and a number of residents are in formal employment in the public service or retail trade (Long 2004).

The conservancy was also one of the first four to be registered in 1998 in Namibia. Membership of the conservancy consists of approximately half of the local adult population. The conservancy is managed by a unique partnership between the conservancy committee and the Grootberg Farmers Union. The conservancy is still financially reliant on donor funding and the annual income for 2002 was N$252 700 (Long 2004). The main enterprises in the conservancy are trophy-hunting, Hoada Campsite, own-use hunting, and Grootberg Lodge. The Grootberg Lodge is a joint-venture partnership where the conservancy owns 100% of the lodge as well as receiving benefits from employment and lodge revenue.

1.5.3 Palmwag Concession Area

The Palmwag Concession Area comprises eight per cent of the Kunene region and is bordered by a range of land use types that include a park, communal conservancies and another tourism concession. Palmwag is bordered to the south and south-east by the Torra Conservancy and the veterinary corridor fence, to the east by the Etendeka Concession Area and the Anabeb Conservancy, to the north and north-east by the Sesfontein Conservancy and to the west by the Skeleton Coast Park. The Hoanib River forms the northern border of the concession (Save the Rhino Trust 2005). The concession covers an area of 5826 km². The area has an altitude range of 300 m to 600 m in the west to a maximum of 1500 m to 1800 m in the east where the flat-topped mountains, the Etendekas, preside. The area is characterized by extremely variable rainfall and arid conditions with an annual rainfall between 50 mm to 200 mm. The area includes four river catchments, namely the Hoanib, Huab, Uniab and Koigab. The major ephemeral rivers in the area are the Hoanib in the north and the Uniab in the southern quarter with its major tributaries, the Barab and Aub. Most of the research done in the concession was conducted in the Barab and Aub tributaries of the Uniab River.

The population density of Palmwag Concession Area is less than one person per km^2; however, there are a number of low-density settlements (between one and five persons per km^2) in the bordering eastern conservancies. There are no permanent human settlements in the Palmwag Concession as the concession is leased by Wilderness Safaris from the Government of Namibia. The concession is currently used for non-consumptive (photographic) ecotourism. There are currently two tourism sites in the concession namely; Palmwag Lodge and Rhino Wilderness Camp. Black rhino tracking safaris are conducted in collaboration with SRT (Save the Rhino Trust) at Rhino Wilderness Camp (Save the Rhino Trust 2005).

1.6 Thesis outline

- Chapter 1 outlines the rationale for the study, states the research problem and formulates two hypotheses to be tested. This is followed by the statement of the overarching aim and the objectives. The chapter also places the research in context and establishes where it fits into the subject of geography. The study areas are demarcated and short backgrounds are sketched for each

- Chapter 2 is the literature review which discusses tourism and its components from a nature-based perspective. Tourism is examined to uncover its role through ecotourism in the development of poor communities in Africa, and particularly in Namibia. The environmental costs and benefits of ecotourism are compared.

- Chapter 3 describes the research design and methodology. The fitting of transmitters to rhinos and the use of telemetry and GIS (geographical information systems) to capture data are discussed. This chapter highlights the methods used to determine home range and explains the methods used in the study. The human induced disturbance (HID) forms are discussed with the identification techniques used for the identification of individual rhinos and, the structure of the questionnaires is explained.

- Chapter 4 reports on data analysis, presents findings about rhino classification, their behaviour and their environmental requirements. The data from the human induced disturbance (HID) forms are analysed through statistical analysis. The home ranges for the studied rhinos are determined and presented using GIS.

- Chapter 5 analyses tourism in the study area. Questionnaire response rate is discussed and compared with tourism numbers during the period in which the research was conducted. The results of the questionnaire survey are analysed statistically and presented.

- Chapter 6 concludes the thesis by discussing the results, drawing conclusions and making recommendations. The home ranges and behaviour of the studied black rhinos are discussed and analysed according to the hypothesis. The results of the questionnaire survey are discussed and the second hypothesis is tested. The thesis concludes with recommendations and possible implications of rhino tracking tourism and its influence on certain environments, as well as future research possibilities.

CHAPTER 2: THE RECIPROCAL IMPACT BETWEEN TOURISM AND RHINO CONSERVATION

2.1 Introduction

Natural areas have always held an appeal for people, and the advent of modern travel has made areas more accessible so that tourists are now visiting places all over the planet (Newsome, Dowling & Moore 2002). Human fascination with wildlife has prevailed as long as the two have co-existed on earth. Our relationship with animals is important because it shapes our feelings for and our actions toward them. This has a direct bearing on our view of animals in relation to tourism. People are especially attracted to rare and dangerous animals such as predators and aggressive herbivores. This explains why the observation of wildlife in African savannah ecosystems is so popular (Newsome, Dowling & Moore 2005).

Tourism in Africa is synonymous with wildlife safaris. Westerners have been preaching tourism as the salvation of Africa for decades (Bonner 1993; Ferreira 2004). Tourism appears to be the only major industrial sector where individual commercial enterprises are simultaneously generating net gains for conservation, communities and shareholders. It is vital to give wildlife and the environment an economic value, and to make local communities central in decision-making. Environmental preservation will become a priority for people as they, and their communities, experience benefits through tourism activity (Buckley 2003; Butcher 2006).

It is evident that there is an important relationship between people and wildlife; one which is directly linked to tourism. Therefore it is necessary to conceptualize tourism and its different components from a nature-based perspective.

Tourism is examined by means of a literature review to determine the role ecotourism plays in development of poor communities in Africa and specifically in Namibia. A comparison is made between the natural environment as a crucial part of tourism in Africa and the environmental costs and benefits of ecotourism. It is also necessary to provide a possible solution to recent problems associated with ecotourism. The specific significance of this chapter is to endeavour to describe the value of the black rhino, as a flagship species, to community-based ecotourism in Namibia.

2.2 Defining tourism

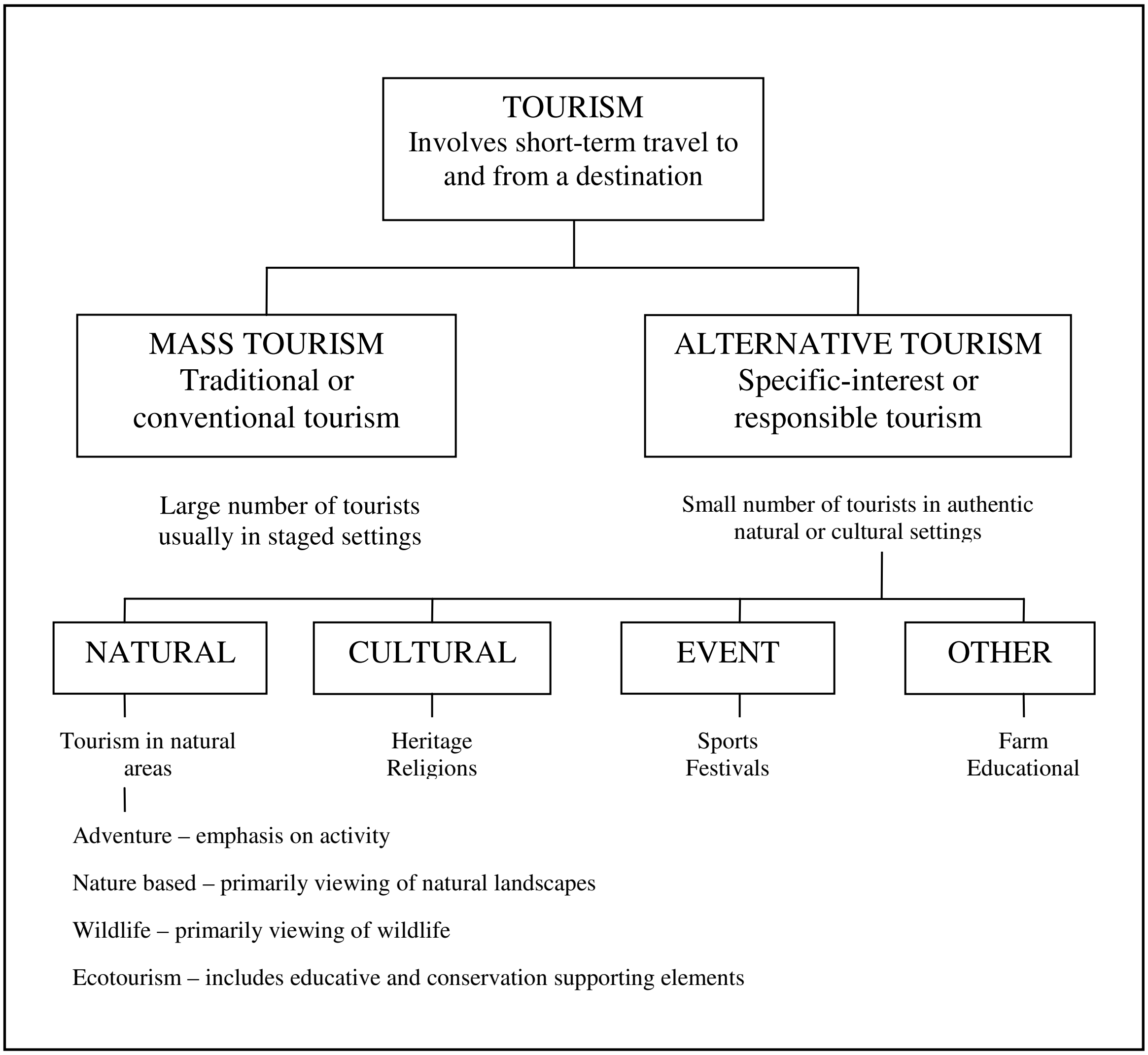
Tourism is a complex and inter-disciplinary subject. The complexity of tourism is defined by its relationship with other disciplines, for example psychology, sociology, anthropology, geography and economics (Fennell 1999). In historical terms tourism is relatively new and has grown markedly over recent years both as an activity and as an industry (Cooper *et al.* 1998; Newsome, Dowling & Moore 2002).

Tourism is often characterized by its dichotomous classification into mass and alternative tourism as indicated in Figure 2.1. Alternative tourism is the most relevant type of tourism when sustainability is emphasized and it can be broadly defined as a form of tourism that sets out to be consistent with natural, social and community values. It allows both host and guest to enjoy positive and worthwhile experiences. Alternative tourism is further divided into natural, cultural, event and other forms of tourism (Newsome, Dowling & Moore 2002).

Newsome, Dowling & Moore (2002) categorize tourism in natural areas as a sub-division of alternative tourism, which is characterized by:

- Tourism in the environment – *e.g.* adventure tourism;
- Tourism about the environment – *e.g.* nature-based tourism and wildlife tourism; and

- Tourism for the environment – *e.g.* ecotourism.



Source: Newsome, Dowling & Moore (2002: 9)

Figure 2.1: Classification of tourism with emphasis on alternative tourism

Ceballos-Lascuráin (1996) follows the same argument by defining nature tourism as all tourism directly dependent on the use of natural resources in a relatively undeveloped state. These include scenery, topography, water features, vegetation and wildlife.

Tourism is economically important and it impacts economies, environments and societies so that it deserves academic consideration. Tourism is also a popular subject that receives recognition from governments because of its importance. This has contributed to an acceleration in the pace of attention devoted to the subject (Cooper *et al*. 1998). Key concepts, which have contributed to this importance of tourism are sustainability and sustainable use.

All tourism should be economically, socially and environmentally sustainable. Sustainable tourism can refer to all segments of tourism markets, from mass tourism through to niche markets, for example ecotourism. A need to achieve a balance between the industry's environmental, social and economic impacts is emphasized in order to guarantee long-term sustainability. To achieve sustainable tourism, equal responsibility lies with government to create an enabling environment and tourism operators to implement sustainable tourism principles. It is also necessary to raise tourists' awareness of the importance of the social, economic and environmental impact of their activities, and their importance to the sustainability of economic activities as well as to the natural resources and assets which they visit to experience (Newsome, Dowling & Moore 2002; Suich, Busch & Barbanchi 2005). Alternative tourism is deemed to be synonymous with the term 'sustainable use'. Several ideas have emerged under the term 'sustainable use'.

Fennell (1999) argues that although mass tourism may be perceived as unsustainable, new and existing developments in the industry have attempted to encourage more sustainable practices. These new developments comprise both socio-cultural tourism and ecotourism. Other ideas about sustainable tourism-use as an imperative or choice, in the pursuit of livelihood strategies, are the need to manage use and to achieve biological sustainability and to ensure the possibility that use can provide incentives to conserve biodiversity (Hutton & Leader-Williams 2003). Livelihood strategies are people-centred. They are not built on what people need to improve their lives but rather the starting point to build on what people have in terms of assets and capabilities as in the case of sustainable tourism; these being natural resources (Long 2004).

2.3 Ecotourism as a form of tourism

Ecotourism is a complex concept which is difficult to define. Ecotourism is based on the natural environment with a focus on its biological, physical and cultural features. It focuses on travelling to relatively undisturbed or uncontaminated nature areas with the specific objective of studying, admiring and enjoying the scenery, wild plants and animals, as well as any existing cultural features (Reid 1999; Isaacs 2000; Newsome, Dowling & Moore 2002).

Hall & Boyd (2005) subdivide ecotourism into the following elements:

- Enlightening, interactive, participatory travel experience;
- Natural and cultural environments;
- Sustainable use of resources;
- Economic opportunities for industry and local communities; and
- Sound environmental management beneficial to all role players.

Kerley, Geach & Vial (2003) argue that ecotourism brings together conservation, development, recreation, culture and education, all of which are powerful tools which could benefit conservation of biodiversity. They also define ecotourism as a complex, multi-disciplinary industry.

The primary goals of ecotourism are to foster sustainable use through conservation of the natural environment, cultural revival, economic development and benefit for people in a position to protect the environment. The latter are the communities who live in that environment. Ecotourism should also contribute to education and generate tourist satisfaction (Newsome, Dowling & Moore 2002; Buckley 2003). Many developing countries promote ecotourism as a means of reconciling economic growth and environmentally sustainable development (Telfer & Sharpley 2008). All these goals contribute to the sustainability of ecotourism. The main defining characteristics of ecotourism fall into two categories, namely environmental inputs and environmental outputs. Inputs are natural and associated cultural features, places of geographic interest in particular, serve as attractions for tourists. Outputs are the net costs to, or benefits for, the natural and social environment. Buckley (2003) describes tourists as geo-tourists as their purpose for travelling is to view particular scenery, wildlife, climb mountains, kayak rivers or experience local cultures. Ecotourism can then be viewed as geo-tourism.

Wildlife tourism which is closely linked to ecotourism falls under nature-based tourism and is defined by Newsome, Dowling & Moore (2005) as tourism undertaken to view and/or encounter wildlife. It can take place in a range of settings, from captive and semi-captive settings to those in the wild and it encompasses a variety of actions from passive observation to feeding and/or touching the viewed species. Wildlife tourism is a form of tourism that is primarily concerned with wildlife and its contribution to local communities is limited. It may include some elements of adventure tourism and ecotourism.

2.3.1 Community-based ecotourism

Community-based ecotourism has become a popular tool for biodiversity conservation. It is based on the principle that biodiversity must pay for itself by generating economic benefits for local people. Community-based ecotourism is defined by Reid (1999) as the use of a community's resources, both cultural and natural, for tourism activities to:

- Promote socio-economic development and provide local people with income sources;
- Encourage community commitment to conservation of bio-diversity and sustainable management of the natural resource base; and
- Involve people in the process of their own development and give them more opportunities to participate effectively in development activities.

Two developments contribute to the emergence of community-based ecotourism. The first comprises recent worldwide activities that promote sustainability and responsible forms of tourism and the second emerges from alternative approaches to protected area management and conservation efforts. Biodiversity conservation is linked to local community development. Conservation organizations often fund community-based ecotourism as a means of reducing local threats to biodiversity, such as expanding agriculture, unsustainable harvesting of wild plants and animals, and killing wildlife that threatens people's crops, their livestock or themselves (Kiss 2004). Community-based ecotourism is also a means for local communities to earn money from ecotourism thus providing an incentive for conservation and an economic alternative to destructive activities.

2.3.2 Environmental benefits of ecotourism

Ecotourism has a number of benefits to society, the greatest being that it grants society with natural capital. Natural capital is defined as biophysical and geophysical processes, and the results of these processes and the relationship of these to human needs over the long term (Butcher 2006). The poorest continent in the world, Africa, can use conservation of natural capital rather than transformation of nature in pursuit of development. This can lead to the expansion of protected natural areas and provide an incentive for private landowners to either maintain or return land to its natural state and to protect wildlife (Beeton 1998). The high value being placed on wildlife by ecotourism gives local communities a reason for wanting to conserve it (Okello 2005).

The growth of ecotourism has resulted in the creation of private game reserves which have become financial institutions. A private 'Big Five game reserve' is worth between R2000 and R4000 per hectare. This would give Kruger National Park in South Africa an estimated value of R20 billion.

One means of gaining economic value from ecotourism related with these reserves is through game sales. A study conducted in KwaZulu-Natal in 2001 found that more than 80% of revenue from game sales came from three species: nyalas and black and white rhinoceroses, the latter two species fetching prices averaging R550 000 for black rhinos and R260 000 for white rhinos (Aylward 2003; Loon 2004).

Beyond the economic value of wildlife are intangible benefits arising from the mere fact that wildlife exists. Loon (2004) states that for many South Africans just knowing, for instance, that their population of rhinos has recovered to healthier levels because of conservation efforts is a source of national pride.

2.3.3 Environmental costs of ecotourism

Nature-based tourism is one of the fastest growing sub-sectors of the tourism industry, the world's largest industry. The implication is that more people will be visiting protected areas. Large and increasing numbers of tourists are having direct and indirect impacts on natural ecosystems and local people (Hutton & Leader-Williams 2003). In contrast, however, a small volume of tourists in culturally or environmentally-fragile areas may have significant impacts (Telfer & Sharpley 2008). The costs of tourism include damage to the living resources that ecotourism is intended to protect. Isaacs (2000), contends that the popularity of ecotourism increases the incentive to preserve wildlife habitat but it also leads to an increase in the occurrence of negative impacts. The most extreme critique of ecotourism entails the element of exploitation - by companies motivated by short-term profits, tourists seeking a self-rewarding travel experience and host communities seeking maximum economic benefit from tourists (Weaver 1998). Tourist impacts on protected areas are broadly classified as direct or indirect. Direct impact is caused by the presence of tourists, while indirect impact is caused by the infrastructure created in connection with tourist activities (Ceballos-Lascuráin 1996).

Tourism has been shown to affect habitats, animals and local communities. This is especially the case when tourism is uncontrolled. Ceballos-Lascuráin (1996) & Okello (2005) report that in Kenya's Masai Mara National Reserve tourism is causing:

- Habitat degradation through off-road driving;
- Disturbance of herbivores by tourist vehicles; and
- Disturbance of large carnivore behaviour, especially cheetahs.

Searching for and observing wildlife at night may also cause disturbance to animals. Newsome, Dowling & Moore (2005) cite spotlighting from vehicles in the Kruger National Park as an example where night driving and vehicle noise may interfere with the hunting strategy of an animal that relies significantly on hearing in order to detect prey. Guided spotlight tours and walking in the Australian wet tropics are also mentioned as areas where animal disturbance is caused.

Getting close to and feeding wildlife is another form of disturbance. Shelton & Lűbcke (2005) refer to the disturbance of yellow-eyed penguins (*Megadyptes antipodes*) at Sandfly Bay, New Zealand. These penguins observe people on the beach awaiting their arrival and will routinely stay out at sea until the coast is clear. This behaviour causes disruption of the changeover of adults during incubation or the delaying of the daily feeding of chicks after hatching.

Wild animals can respond to human attention according to recognized behavioural responses of avoidance, attraction and habituation. Responses could include avoidance of humans by way of alarm behaviour, alertness followed by agitation, and then escape to a safer distance. There could also be a danger of wildlife becoming accustomed to and dependent on humans for food in tourism areas. Tourist activity might result in animals avoiding their optimal resting and feeding areas. Finally, tourism may cause disturbances to reproduction and maternal care (Newsome, Dowling & Moore 2002).

Tourists need to be more responsible when visiting ecotourism sites. Fundamental to the successful development of more appropriate forms of tourism is the need for tourists to act more responsibly and to be conscious of sustainability (Telfer & Sharpley 2008). The concept of responsible tourism is discussed in the next section.

2.4 Responsible tourism: the answer to ecotourism's harmfulness

Ecotourism is widely seen as a means of combating the negative effects of mass tourism. However, ecotourism itself has become so spoiled by unscrupulous operators and a gullible public that its validity as a concept needs to be questioned. Questions have been asked about the effects of ecotourists on the stress (and hence the reproductive) levels of mammals and birds in ecologically sensitive areas. This has led to a call for baseline studies on animal physiology prior to the initiation of ecotourism activities taking place in such areas. The negative views on ecotourism in recent times have led to the emergence of responsible tourism as the term of choice for Tourism Concern and other organizations (Responsible Tourism Handbook 2007; Telfer & Sharpley 2008).

Since the mid 1990s there has been a shift toward defining economic performance in terms of the "triple bottom line" – development growth, which is economically, socially and environmentally sustainable. Responsible tourism addresses this shift by giving equal weight to the economy, society and the environment – the three pillars of sustainable development (Responsible Tourism Handbook 2007).

The term 'responsible tourism' is a rather vague concept and encompasses a tourism management strategy embracing planning, management, product development and marketing to result in positive economic, social, cultural, and environmental impacts (Buckley 2003; Responsible Tourism Handbook 2007). Tourism operators should provide more rewarding holiday experiences for guests whilst enabling local communities to enjoy a better quality of life and conserving the natural environment.

Responsible tourism is based on the following environmental guidelines:

- Reduce environmental impacts when developing tourism;
- Use natural resources sustainably; and
- Maintain natural biodiversity.

As natural resources sustain the livelihoods of millions of people, biodiversity loss has a direct impact on quality of life. Responsible tourism may well be a matter of survival for local communities who need to be meaningfully involved in tourism to perceive its benefits. Good economic practices can create jobs, stimulate entrepreneurship and boost regional economic growth. Responsible tourism ensures that all sectors of society benefit from a virtuous tourism cycle (Responsible Tourism Handbook 2007).

2.5 Community-based tourism in Africa

Wildlife is one of Africa's greatest assets and is likely to be envisaged in terms of the potential income it can generate through safaris, hunting and game watching. This contributes to the development of communities (Ferreira 2004; Massyn 2007). Local inhabitants in Africa have to carry the burden of living with wildlife. They receive very little of the profits generated by wildlife-based industry. Ecotourism ventures may be the best option where the potential exists for providing wildlife benefits to impoverished local communities in Africa by sharing the profits. This has led to a new ecotourism initiative, namely community-based conservation (Okello 2005).

New approaches to community-based conservation and development have been increasingly applied in several areas of southern Africa. The safari hunting tourism industry is an example of community-based tourism that has developed in African countries. This industry is a significant and sustainable source of income to offset the cost of maintaining protected areas in Africa. Trophy-hunting is conducted in 23 African countries, with large hunting industries in southern and east Africa and smaller industries in central and west Africa. In general, southern African countries obtain as much as 50% of their tourism proceeds from hunting safaris. Trophy-hunting can play a conservation role. Only two to five per cent of male populations are usually used for this purpose, which could be sustainable and low-risk if well-managed. It can also play a role in endangered species conservation and in the rehabilitation of wildlife areas, permitting income generation without jeopardizing wildlife population growth. An example is the role hunting revenues played in the recovery of the white rhinoceros populations in South Africa (Lindsey *et al.* 2006).

Project CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) is an excellent example of communal-land trophy hunting. CAMPFIRE was established in the late 1980s and is well known as a pioneering and successful project that has promoted wildlife conservation and community development through tourism (Telfer & Sharpley 2008). The programme enables rural communities to generate an income through hunting tourism of animals that would otherwise be poached because they are considered to be pests (Lovelock & Robinson 2005). Dzingirai (2003: 450) states: "In keeping with community-based management practice, the programme proposes the passing of management benefits, in particular game meat, wildlife-generated revenue, and protection from crop raids, to the 'producer community', for example those people who have long lived with wildlife." The project was started because a large amount of wildlife occurred outside protected areas and both private and communal land holders had little or no incentive to manage it, causing wildlife habitat and numbers to decline. Two rural councils were granted Appropriate Authority status in 1988 and CAMPFIRE has since encompassed some 30 rural district councils or about 36 000 km² of communal land outside protected areas (Hutton & Leader-Williams 2005). Sport-hunting contributed 90% of revenue to these communities with the hunting of elephants contributing more than 60% (Bond 1994).

Project CAMPFIRE has, however, experienced problems. Zimbabwe was until recently a leading country in Africa regarding issues of natural resource use in rural areas. It pioneered the concept of community involvement in the management of wildlife resources. Key structural and political issues influenced more widespread progress in project CAMPFIRE. A key principle of CAMPFIRE was that the main beneficiaries of collective interests should be the communities. This has never been legally enshrined and these communities still cannot be granted ‘Appropriate Authority’ status (Dzingirai 2003). Only rural district councils can enjoy this status (Hutton & Leader-Williams 2005). The rural district councils and, increasingly, central government were given the opportunity to appropriate revenue. But the social and economic crisis in the country is destroying the proud heritage of the Zimbabwean conservation tradition. Tourism has diminished as refugees flee the country and political instability has contributed to frightening potential visitors away (Ferreira 2004). Hughes (2001) alleges that project CAMPFIRE has failed because the project has turned into what he calls “cadastral politics”. The country focuses on measures, demarcation and control of land. Smallholders fight over access to land and, at another level, the State, corporations, and the leaders of smallholder communities contest the division of territory. Economic ambition and historical grievances are dominated by hectares. Territorial conflict is seen as the issue that is destroying the project.

2.6 Tourism in Namibia

Namibia’s economy is heavily reliant on its natural resources. This is made evident by the fact that just over 14% of Namibia’s land is formally protected in protected areas. Tourism is a pillar of the Namibian economy together with mining, agriculture and fishing. The tourism industry in Namibia is widely viewed as having major potential for economic growth and development, with international arrivals having grown steadily over the past 15 years to over 600 000 in recent years and an average growth rate of around 16% a year over that period (Turpie *et al.* 2005). It is an important employment generator, particularly in the rural areas where most tourism activities occur (Namibia 2003a). The tourism product in Namibia is based on wildlife and spectacular scenery, with product differentiation between protected areas (conventional safaris), private wildlife reserves (luxury safaris), commercial farmland (hunting, farm stays) and communal (more adventurous safaris and/or exclusive wilderness) (Ashley 1998). Nature-based tourism activities (nature and landscape touring – 51%, game viewing – 45%) are the top reasons given by most visitors for coming to Namibia (Turpie *et al.* 2005). Tourism results in the environment being an important but vulnerable asset (Storm 2001).

Ecotourism is one of the main issues dealt with in Namibia's Vision 2030. An objective of the government's Vision 2030 is to ensure the development of Namibia's natural capital and its sustainable utilization for the benefit of the country's social, economic and ecological well-being. Its broad strategies include the maintenance of stable, productive and diverse ecosystems managed for long-term sustainability. In addition to the contribution to Namibia's economy, the tourism industry is capable of:

- Contributing to wildlife conservation and biodiversity protection;
- Contributing to poverty alleviation, particularly in rural areas, through direct and indirect employment; and
- Improving the earning ability of rural women and enhancing traditional Namibian culture by stimulating trade in basketry, pottery and other traditional crafts (Namibia 2003c).

Namibia is a leader in community-based natural resource management. The country's wildlife and scenic communal areas are widely thought to hold significant potential for increased economic activity, especially in the form of photographic tourism. The country appears to have made significant progress towards a tenure regime in its communal areas that is more conducive to tourism investment (Massyn 2007).

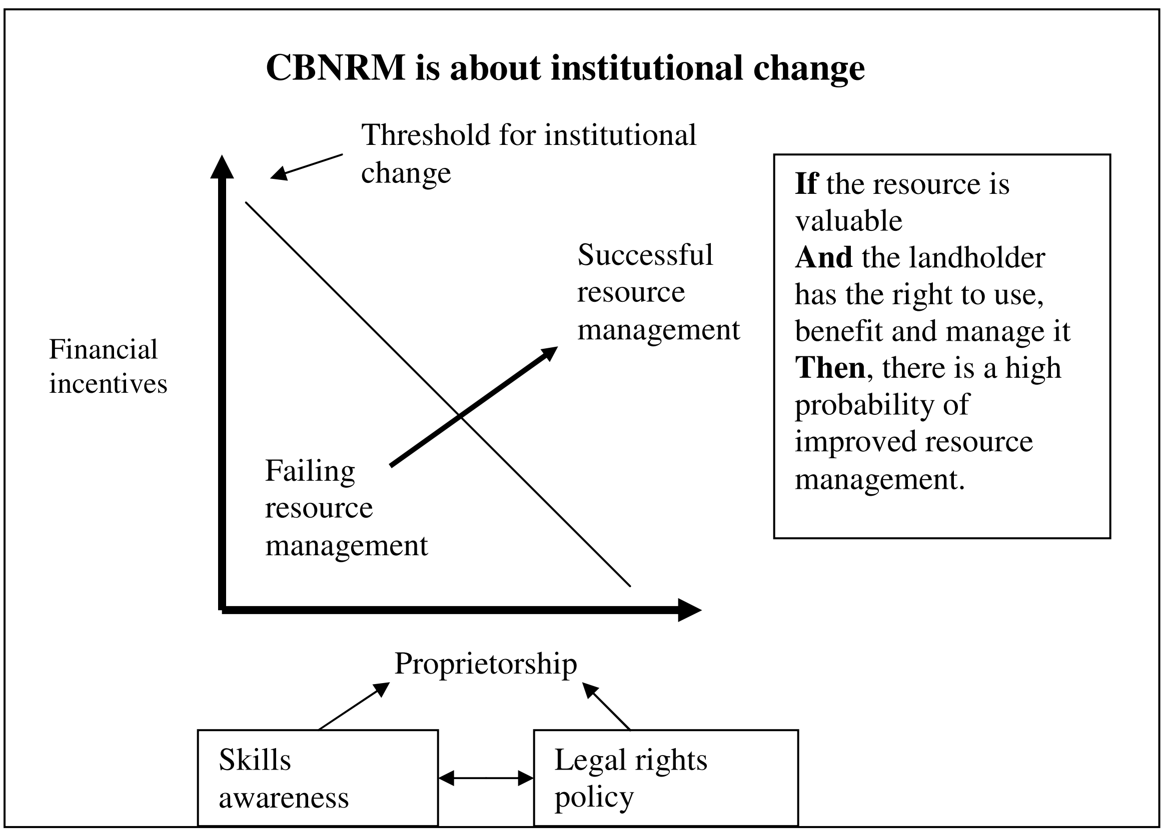
2.6.1 The community-based natural resource management (CBNRM) programme in Namibia

Community-based wildlife conservation was pioneered in the mid 1980s as a response to decreasing numbers of wildlife in the north-west of Namibia, the worst affected being elephants and black rhinos because of drought and heavy poaching (Jones 2003). Local communities bore all the costs of living with wild animals without any rewards. This resulted in poaching where the local communities had no incentives for conservation of the wildlife. The response came from local leaders in north-western Namibia during the early 1980s. It led to the formation of the community-based natural resource management programme (CBNRM). The most significant factors that led to the CBNRM programme in Namibia were the concerns of rural residents over better wildlife management, the experience of conservation NGOs working in the north-west of the country, experience and lessons learned from the CAMPFIRE project in Zimbabwe and similar projects elsewhere in Africa, lessons learned from the freehold farming sector, as well as the development of common property resource management theory (Jones 1999).

The basic assumption of the CBNRM programme is that wildlife and tourism are desirable and offer the best comparative advantage for marginal lands in the long term. The CBNRM programme in Namibia aims to provide incentives for local communities to manage wildlife sustainably as a common property resource. The programme is a joint initiative of the Namibian government, NGOs, community-based organizations and rural area residents, with technical and financial support from international donors and conservation agencies (Davis 2001). It is based on the assumption that if the benefits to communities outweigh the costs and communities gain sufficient proprietorship over wildlife, sustainable use is likely (see Figure 2.2). The CBNRM programme is seen as a contributor to achieving broad development and conservation goals in Namibia (Long 2004). The programme is really more of a movement than a project; one that is seen by some as the leading model in the country for a more integrated and holistic approach to rural development (Jones, Wahome & Araseb 2001). The CBNRM programme is also associated with managing and distributing tourism revenue generated as a result of improvements in resource management (Long & Jones 2004).

The CBNRM programme simultaneously addresses several objectives, namely:

- It brings a new set of natural resources into production;
- It creates incentive to manage wildlife and other natural resources sustainably;
- It boosts the abundance and productivity of natural resources;
- It unlocks the economic potential of wildlife and tourism in communal areas;
- It supports and promotes the establishment of local management institutions;
- It builds empowerment, capacity, and skills at local level; and
- It corrects discriminatory imbalances of the past (Long & Jones 2004).



Source: Jones (2003: 19)

Figure 2.2: Relationship between financial incentive and proprietorship

The relationship between improvements in natural resource management and deriving benefits from tourism is multiple. On the one hand, improved wildlife numbers attract tourists. This consequently results in planning for core wildlife and tourism. Areas where a variety of land management practices takes place may add substantially to the tourist experience where expectations of unadulterated wilderness are high. Planning may also assist in times of crises for managing grazing and water for both wildlife and livestock. Tourism provides cash incomes and jobs and presents a rationale for local people to stay in their rural areas in order to develop long-term sustainable livelihoods. If tourism revenues can be fed back into natural resource management, whilst simultaneously providing visible individual and community benefits, then the long-term viability of integrating tourism into the sustainable livelihoods of rural communities makes sense (Long 2001).

2.6.2 Communal conservancies in Namibia

The CBNRM programme in Namibia was supported by enabling policy and legislation passed in 1996 and 2002 by the Namibian government. Residents of communal areas are granted conditional legal rights to manage and benefit from wildlife and tourism if they form a management structure called a conservancy. The empowering legislations are the Namibian Conservation Act of 1996, which devolved certain resources to local communities organized in the form of communal conservancies, and the Communal Land Reform Act of 2002 which renovated the administration of land in communal areas. These reforms have improved the general environment for tourism development in the communal areas by granting local residents valuable commercial rights and creating a framework for modernized land allocation (Massyn 2007). These legislative reforms are supported by Namibia's Vision 2030 which grants all citizens who are able and willing an equal opportunity to access and utilize the natural resources in the country for their own benefit and the benefit of their families, communities and the nation (Namibia 2003c).

The conservancy movement has markedly changed the attitudes of communal area residents and communities have been integrating wildlife and tourism enterprises into their livelihood strategies since 1996. Prior to the passing of this empowering legislation, wildlife was deeply resented, as it competed with livestock for grazing and water, preyed on livestock, and many species routinely damaged crops and infrastructure (Jackson, Weaver & Pieterse 2007).

Conservancies are legally recognized, geographically defined areas that have been voluntarily formed by communities to manage, and thus benefit from wildlife and other natural resources (Jackson, Weaver & Pieterse 2007). A communal conservancy consists of setting aside part or all of the land of a given community with the intention to conserve and value wildlife through its sustainable consumptive and non-consumptive uses within nature-related activities. Consumptive rights include the conditional ownership and use of game that can be hunted as trophies or for local consumption by conservancy members, cropped for commercial saleable meat, or captured and sold as live game. Non-consumptive rights over wildlife create opportunities for tourism, enabling conservancies to establish their own community-based tourism enterprises or to create joint-venture agreements with private sector entrepreneurs (Hearn 2003). Conservancies are not game reserves because communities can carry on their usual farming and other economic activities (Namibia 2007).

The Minister of Environment and Tourism will declare a conservancy in the government gazette if:

- The community applying has elected a representative committee and supplied the names of the committee members;
- The community agree upon a legal constitution, which provides for the sustainable management and utilization of game in the conservancy;
- The conservancy committee has the ability to manage funds;

- The conservancy committee has an approved method for the equitable distribution to members of the community of benefits derived from the consumptive and non-consumptive utilization of game;
- The community has defined the boundaries of the geographic area of the conservancy; and
- The area concerned is not subject to any lease or is not a proclaimed game reserve or nature reserve (Jones 1999).

The first four communal conservancies were proclaimed in 1998, followed by five additional conservancies in 1999. Conservancies continued to be proclaimed and by 2007 there were 50 with roughly 30 more expected within the next two to three years (Jackson, Weaver & Pieterse 2007).

Conservancies boost wildlife numbers by:

- Expanding areas under conservation management;
- Managing and protecting wildlife populations;
- Reintroducing game animals from both private and public donors; and
- Bolstering the viability of Namibia's protected area system through the establishment of wildlife-friendly zones adjacent to parks (Jackson, Weaver & Pieterse 2007).

The conservancies enjoy numerous benefits, including collective incomes from hunting and photographic lodges, much needed employment for rural community residents, skills training in the hunting and tourism industries, meat from harvesting animals, and strengthening of governance. These benefits create incentives and assistance for local communities to increase wildlife populations, zoning conservancies to counter growing human and animal conflicts, as well as giving rural people a voice to influence their own long-term development (Jackson, Weaver, & Pieterse 2007). In an assessment of the Godwana Canon Nature Reserve, Barnes & Hamavindu (2003) found that wildlife production and tourism enterprises not only generate greater revenue per hectare and higher levels of employment than agriculture on neighbouring farms, but also point out the significantly more ecologically-friendly and sustainable management influences the wildlife/tourism enterprises have on Namibia's arid and semi-arid ecosystem.

After the registration of the first four conservancies 1998, income and benefits have grown steadily from less than N$600 000 in 1998 to N$13.7 million in 2005. This growth has coincided with the parallel growth of the tourism industry, and conservancies have earned much more from tourism than from any other activity. The most lucrative source of income has been from joint-venture tourism lodges and camps in which conservancies negotiate a levy or income-sharing agreement that accounts for 56% of all conservancy income. Trophy-hunting concessions currently provide the second highest source of income for conservancies, accounting for 27% in 2005. Conservancy committees are receiving a greater proportion of their funds from trophy hunting than from photographic tourism (Namibia 2003a). Trophy-hunting tourism allows the conservancy to derive income from the presence of wildlife. The cost of living with wildlife has a tremendous effect on local people who depend on livestock and crops for survival. Conservancies are able to benefit from wildlife through trophy-hunting. A male lion was trophy-hunted for US$10 000 by Torra Conservancy in 2001 (Arnold 2001). These benefits go a long way in compensating for the loss of livestock that lions could inflict on local communities and could prevent the communities from taking matters into their own hands when it comes to human-wildlife conflict.

Communities need private companies to provide investment, realistic assessment of potential, management, expertise and marketing of their products to clients. Communities provide access to land and certain exclusive rights. The private investors make profits from the businesses they operate, while the communities benefit from a combination of rents and bed-night fees (Namibia 2003a). In order to become successful, joint ventures must be equitable, demanding trust, understanding and equal commitment from both parties. Joint ventures are a means for conservancies to benefit where skills and knowledge are lacking.

The first venture of this kind, Damaraland Camp, opened in Kunene region in 1996 as a partnership between the Torra Conservancy and Wilderness Safaris (Ashley 1998). In 2004, Damaraland Camp was awarded a UNDP Equator Initiative Prize for outstanding achievement in the reduction of poverty through conservation and sustainable use of biodiversity. In 2005 it was awarded a World Travel & Tourism Council Award for conservation (Wilderness Safaris 2009). At the end of 2005 there were 10 joint lodges and 22 formal joint-venture agreements in operation, generating income for conservancies, and a further 13 potential joint-venture agreements under negotiation. A joint-venture lodge generates more types of local benefits, and greater cash benefits than a conventional private lodge. The former is less likely to bring about disempowerment of the community or alienation from resources but it entails new kinds of costs for the community, such as effort and risk, and such lodges are not always feasible (Ashley 1998).

2.6.3 Concessions in Namibia

Concessions on state land have significant roles to play in Namibia and they complement other contributors to the country's economy. They are a means of providing access for tourists to parts of protected areas which are usually not accessible; they diversify the range of hunting opportunities on offer; and they generate additional revenue for the state in a sustainable way from plant and wildlife resources. Concessions also create opportunities for business development and the economic empowerment of formerly disadvantaged Namibians through access to tourism, hunting and industry based on wild plant and animal resources. Improving access to public resources for the empowerment of formerly disadvantaged Namibians with the aim of uplifting this portion of the population is of the utmost importance (Namibia 2007).

Concession means the right, whether full or restricted or shared or exclusive, to conduct tourism activities and/or to use state-owned plant and/or animal resources (collectively referred to as wildlife resources) commercially for business principles in proclaimed protected areas and any other state land for a specified period (Namibia 2007).

There are four types of concessions in Namibia's policy on tourism and wildlife concessions on state land (Namibia 2007). These are listed below.

- Tourism: These concessions could entail a combination of various types, for example the right to develop a lodge within a specified area, to offer tourism services such as guided tourism within a specified area, or to offer more specialized tourism services such as adventure tourism. Tourism concessions provide an opportunity to establish tourism in situations which characterize Namibian parks, where sensitive habitats and substrates or other limiting factors require strict limits on the use of such areas for tourism. These can often only be accomplished through a highly controlled or specialized form of tourism.

- Plant materials: These concessions entail the harvesting of plant material.

- Trophy hunting: Trophy hunting concessions represent valuable economic assets, foreign currency earning capacity and hunting experience with considerable international marketing potential. These concessions can be beneficial in rural areas by contributing to the management of declared problem animals, providing meat for distribution, addressing overpopulation of certain species and generating revenue from land or resources that are otherwise unproductive.

- Other uses of wildlife: There may be a need in future to regulate the commercial use of certain other wildlife resources under state ownership through concessions.

The largest concession in Namibia is the Palmwag Concession Area. The concession is currently being used for tourism by Wilderness Safaris. The concession has four of the 'Big Five' present in its boundaries. The most important being the desert-adapted black rhino. The black rhinoceros is the flagship species of the concession and it is currently being used for rhino-tracking tourism at the Rhino Wilderness Camp. The camp is a joint venture between SRT and Wilderness Safaris to lead rhino-tracking safaris. The aim of the project is to use tourism directly to support the monitoring costs of rhino conservation in the area, while directly linking rhino conservation goals to regional development and economic growth (Adcock 2005; Spenceley & Barnes 2005).

Because the value of this flagship species is extremely important for tourism in the area and in the country as a whole it is examined in greater detail in the next section.

2.7 The value of black rhinos

The black rhinoceros used to be the most widespread and numerous rhino species in the world (Estes 1991). Since the 1970s, however, its decline has been catastrophic. The last three decades have seen black rhino (*Diceros bicornis*) populations in Africa decrease by 97%, almost entirely due to the lucrative black-market trade in rhino horn. Black rhino numbers have been reduced from 70 000 in the late 1960s to fewer than 3 300 in 1990 and an estimated 2000 in 2000 (Stevens-Wood 2000). The black rhino has become extinct or is nearing extinction in over 12 African countries (Slattery 2003). Recently the species has started to recover. The World Wide Fund for Nature estimated the population in 2005 at approximately 3,600 individuals (WWF 2006).

Rhinos represent a flagship species because they have been chosen strategically to raise public awareness or financial support for conservation by encouraging people from the West to visit developing countries to see them. The most important characteristic of a good flagship is raising support or funds that are used more widely than for the preservation of the flagship alone (Walpole & Leader-Williams 2002; Mace, Possingham & Leader-Williams 2007). Loon (2004) believes that by raising the total economic value of these flagship species, the other species in these areas, as well as the protected areas that support them, are protected.

Rhinos act as true flagship species because:

- They require large areas and protection measures that help conserve a wide range of biodiversity;
- Their conservation as rare and charismatic animals attracts donor and state support, the latter being stimulated by the national prestige of a rhino conservation project; and
- Rhinos are a major attraction for ecotourists and they have a high value in live sales, thus generating revenue for wildlife operations (Du Toit, Brooks & Emslie 2006).

As a result, black rhinos are viewed as having great value to society and conservationists. “Rhinos must be presented as robust species that can play a very positive role in sustainable wildlife industries, to the economic benefit of rural people” (Du Toit, Brooks & Emslie 2006). The value of black rhinos can be realized through consumptive and non-consumptive use, both of which have the potential to generate significant amounts of economic income and to contribute to the livelihoods of rural people (Spenceley & Barnes 2005).

2.7.1 Consumptive use of black rhinos

The consumptive use of black rhinos includes trophy-or sport-hunting, horn harvesting and trade in rhino products. Trophy-hunting has proven to be sustainable in South Africa and Namibia, to create jobs, generate income, increase the incentives for private and community conservation and help subsidize the high cost of monitoring, protecting and managing rhinos. In South Africa the hunting of white rhinos generated US$24 million from 1968 to 1996. The number of white rhinos in the wild increased from 1 800 to 13 500 from 1968 to the end of 2005. This 650% increase indicates that decreasing levels of these animals have been sustainable. In 2004, at the 13th CITES Conference of Parties, an annual hunting quota of five ‘surplus’ black rhino males for South Africa and Namibia was approved. The level of decrease of these black rhinos represents less than 0.5% of the population (Emslie 2004; Leader-Williams *et al.* 2005; Du Toit, Brooks & Emslie 2006). To date, only South Africa has used its quota. According to the Ministry of Environment and Tourism the reason behind this was to let South Africa take the lead in the trophy-hunting of black rhinos, and that there was a delay in assigning trophy-hunting concessions in Namibia (Beytell 2008, pers comm).

The most controversial consumptive use of black rhinos is horn harvesting and the trade in rhino products. There have been arguments for the safe removal of rhino horn, which can grow back at 6 cm per year for front horns and 3 cm per year for rear horns, to produce legal horn to meet the demand for traditional medicine and by doing so, eliminate illegal trade (Emslie & Brooks 1999; Du Toit, Brooks & Emslie 2006). The legal trade in rhino horn and other rhino products is currently banned under CITES. A quota to be approved with a two-thirds majority at a future CITES Conference of the Parties is required for this to become a reality, something that is unlikely in the foreseeable future, particularly in the light of current poaching in South Africa.

2.7.2 Non-consumptive use of black rhinos

Conservation is not financially self-reliant and, therefore, one of the means contributing to finances for conservation is through the non-consumptive use of black rhinos. Non-consumptive use refers to ecotourism and the live sales of rhinos (Emslie & Brooks 1999; Loon 2004; Ramutsindela 2004).

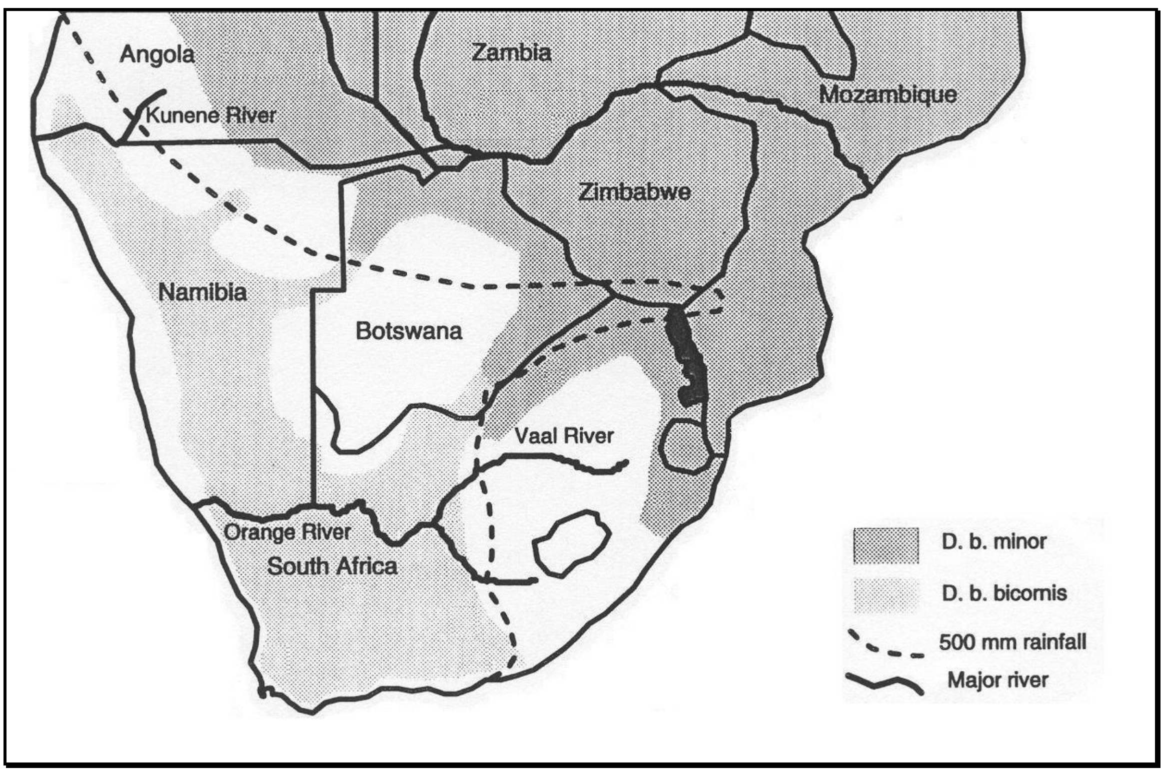
Live sales, primarily by auction, generate enormous amounts of revenue, some of which is destined for conservation. In South Africa, black rhinos sold at auctions averaged R550 000 per rhino in 2001 (Aylward 2003; Loon 2004). At the MET 2008 Wildlife Auction, eight black rhino were sold at a price of N$500 000 each (Beytell 2008, pers comm). Between 2000 and 2005, live sales of rhinos from Hluhluwe-Imfolozi Park in South Africa generated the equivalent of 60% of the park's conservation budget. The main motivations for people to buy rhinos were for photographic tourism, hunting, or their aesthetic value (Spenceley & Barnes 2005).

The ‘Big Five’ especially the black rhino, are major tourist attractions. International tourists are willing to pay substantial amounts of money to view black rhinos. Southern African wildlife operations that include rhinos are regarded by tourists as more prestigious than parks without rhinos. Surveys of tourists in private reserves in South Africa and Namibia indicate that 7 to 14% of total wildlife viewing value can be ascribed to rhinos (Spenceley & Barnes 2005). This is evident in the Kunene region of Namibia where tourism has been influential in the success of the growth of the Kunene rhino population over the last ten years. Sibalatani (2004) points out that the tracking of black rhinos is an attraction that influences the decision of tourists to visit the Namibian region. Rhino-tracking tourism is currently being conducted at Rhino Wilderness Camp in the Palmwag Concession Area. The camp is an example of the value of rhino-tracking tourism as an economic activity. Through proceeds from the camp, Wilderness Safaris are able to pay the wages of four SRT staff in addition to financing their vehicle and operational costs. A further 5.5% of the income from tourist accommodation is donated to SRT. Tourists pay an average of US$223 per person for a full night’s board at the camp, which includes the tracking (Spenceley & Barnes 2005).

Rhino-related activities can benefit local communities encouraging these communities to become actively involved with black rhino conservation. In Zimbabwe’s south-eastern Lowveld and in Namibia’s arid Kunene region, rhino conservation programmes have been major catalysts in the formation of commercial and communal conservancies (Spenceley & Barnes 2005). Emslie & Brooks (1999: 69) acknowledge that: “Where people have benefited directly from rhino conservation, through ecotourism ventures or employment in rhino monitoring and protection, the rhinos have also benefited significantly.” One must conclude that the income generated through tourism could contribute substantially to the conservation of this species and the sustainable development of local communities. The conservation issue is addressed in the next section.

2.8 Black rhino conservation in Namibia

Black rhinos were once abundant throughout Namibia according to Barnard (1998: 78): “Before the 1800s, black rhino were widely distributed in Namibia except for the Kalahari and western Namib, which lack surface water.” The former range of black rhinos extended from the Kunene river southwards along the escarpment to the Orange River and eastwards past Gobabis. The historic range also extended into southern Angola, western Botswana and the northern and western Cape of South Africa (see Figure 2.3). Populations have declined drastically since then because of crimping ranges, mainly due to human settlement, hunting and recently, poaching for rhino horn. According to Joubert (1971), a census conducted in 1966 revealed a black rhino population of 90 remaining in the whole of South West Africa (Namibia).



Source: Du Preez (2000: 31)

Figure 2.3: Historic distribution of black rhino in the SADC region

Today, Namibia has Africa's largest unfenced population of black rhino, and about 97% of the arid adapted ecotype or subspecies *Diceros bicornis bicornis* (Barnard 1998). Namibia also has two Key 1 populations of black rhino, in Etosha National Park and the free-ranging Kunene population, and one Important 1 population in the Waterberg Plateau Park. A key population is a population whose survival is considered critical for the wider survival of the species and an important population is considered extremely valuable in terms of the survival of the species (Emslie & Brooks 1999).

The conservation value of rhino populations is judged by:

- Population size;
- Significance of the population in conserving the relevant subspecies; and
- The likelihood of protection/conservation measures being effective (Emslie & Brooks 1999).

The subspecies, or probably more correctly ecotype, *Diceros bicornis bicornis* is adapted to drier, arid conditions and mainly occur in the north-western part of Namibia (Hearn 2003). The total population of the country is estimated at 1 480 (Namibia 2009). The four biggest rhino range states, South Africa, Namibia, Zimbabwe and Kenya, as well as Tanzania and Botswana, have rhino plans that recommend very similar strategies. All of these countries have a minimum meta-population growth target of five per cent, and conservation agencies are called upon to manage their rhino populations adaptively to maximize growth rates (Brooks 2001). The black rhino conservation policy of the Namibian government envisages the re-establishment of the subspecies/ecotype *Diceros bicornis bicornis* in a viable, healthy breeding population in its former range and to use the black rhino population in a sustainable manner (Namibia 2003b).

Namibia has invested substantial public and private funds in several pioneering rhino management strategies. These include:

- Community game guards, which are patrol units controlled by rural communities with donor funding as part of a broader community-based conservation and tourism approach;
- The Wildlife Protection Services (WPS), an anti-poaching patrol unit of the Ministry of Environment and Tourism;
- A custodianship programme, in which rhinos are 'loaned out' to well-guarded private farms meeting stringent requirements; and
- Dehorning of rhinos as a deterrent to poachers (Barnard 1998).

Namibia is one of the few countries in the world to make provision for the protection and use of its natural resources and biodiversity in its national constitution (Namibia 1998). Rhino are legally protected in Namibia and have the same legal status regardless of their origin or locality. Permit control applies to all aspects of possession, translocation and hunting of the species, as well as the possession of, trade in, and the export or import of rhino or rhino parts. Disregard for these regulations is punishable by a fine of up to N$200 000 and/or imprisonment for up to 20 years (Namibia 1998; 2003b).

2.8.1 Most significant fenced black rhino populations in Namibia

More than two thirds of the total population of black rhinos in Namibia is located in three major populations, namely Etosha National Park, Kunene/Erongo, and Waterberg Plateau Park (Namibia 2003b). The fourth largest population of black rhinos is part of Namibia's Custodian Programme which is spread across most of the country on private and conservancy land.

The largest population in the country is located in the Etosha National Park. The park also holds the largest population of black rhino on earth, which is why it is considered a Key 1 population according to the African Rhino Specialist Group (AFRSG). From 1968 to 1977, 68 rhinos were moved from the Kaokoveld to supplement a small population of about 150 in the Etosha National Park, now totalling between 996 and 1197 animals. The second largest population of black rhinos in a Namibian national park is in the Waterberg Plateau Park, with an estimated 40 animals. Seventeen black rhinos were translocated from Etosha National Park and ten from Damaraland in 1989. The operation took place as an emergency measure due to an increase in poaching in these areas. The population in the Waterberg Plateau Park has a relatively low growth rate due to the sub-optimal quality of the habitat (Du Preez 2000; Namibia 2010).

Namibia also has a black rhino population on privately-owned land. These animals are part of Namibia's Custodianship Programme, as mentioned above, where suitable landowners are identified by the Ministry of Environment and Tourism and breeding groups of rhino are translocated to these properties. These landowners are responsible for protecting the rhinos. They have the benefit of having the animals on their property for non-consumptive use such as tourism. The rhinos, their offspring and all products remain state property. The programme was started in 1993 when two free-hold farms received 11 black rhinos. Black rhinos are also reintroduced onto communal land within the custodianship system, benefiting local communities and elevating the status of rhinos among communities to one of a valuable cash crop that never needs harvesting. Communal conservancies became part of the Custodianship Programme in 2004 with the translocation of black rhinos to Uukwaluudhi Conservancy. Presently, the programme has 36 members of which 11 are communal conservancies housing more than 380 black rhinos (Bruin 2005; Namibia 2010).

2.8.2 The free-ranging black rhinos of Namibia

Namibia's black rhino population which inhabits communal land in the Kunene was heavily poached in the 1970s and early 1980s. Poaching of this population from 1975 to 1981 by Hereros and Himbas using mainly .303 rifles, and a heavy drought, reduced the numbers to 66 animals in 1982 (Martin 1994; Loutit 1996). Conservation measures introduced at the time led to a steady increase in rhino numbers. These conservation measures involved locals in monitoring programmes, followed by the initiation of the community game guard scheme and by the mid 1980s specific rhino monitoring patrols made up of community members led by Save the Rhino Trust (SRT) (Hearn 2003). SRT was founded to monitor the black rhino population in north-west Namibia. In 1989 poaching increased because of unemployment in the area, exacerbated by the return of thousands of political refugees, the partial redundancy of many men formerly employed by the South West African Territory Force and the availability of many more firearms. The upsurge in poaching in 1989 led to the dehorning of 12 rhinos to deter poachers. The exact number was first kept secret from the press to give the impression that most rhinos in the area had been dehorned. In 1991 the dehorning operation was repeated in southern Damaraland when at least eight rhinos had their horns sawn off. The 1989 operation was the first ever to be carried out in the world on a wild population (Martin 1994).

SRT, MET, conservancy field staff and community game guards presently conduct continuous surveillance of the population. The functions of these patrols are to obtain long-term data on individual rhinos, their movement patterns and population performance as well as the deterrence and detection of poachers and other illegal activity. “The rhino monitoring staff of SRT earn a bonus for every rhino properly photographed and identified, which ensures that the monitoring staff takes a personal interest in the welfare of the rhinos with which they work” (Loutit 1996: 32). The identification of the rhino is determined by using photographs and identity forms (see Appendix B). The identity forms are completed during each sighting. Rhinos are tracked from their spoor and observed at close range to detect all ear notches, horn shapes, angles and sizes, scars and anatomical defects, tail and shape, hair on ears and tail and anything else that may help to identify the rhino (Namibia 1998).

These black rhinos represent the only desert-adapted ecotypic population (*Diceros bicornis bicornis*) and one of the few remaining populations worldwide surviving on land that has no formal conservation status. The population is located on communal land and the total population estimate was 142 animals as at 31 December 2003 when the last quinquennial census was conducted by SRT and the Ministry of Environment and Tourism (Hearn 2004). This population is located in the Kunene region – an area of approximately 70 000 km² in the north-west of Namibia and it is perceived as a Key 1 population (Emslie & Brooks 1999; Hearn 2003; Adcock 2005). The extreme aridity of the area contributes to the Key 1 population status. The aridity and general lack of browse of the area cause the rhinos to move long distances for food and water, probably more than any other rhino population in Africa (Martin 1994). The rhinos range over an area of approximately 20 000 km² (see Figure 2.4). The range mainly covers uninhabited, arid country between the Skeleton Coast Park and communal farming areas to the east. The rhino density is estimated at 0.01 rhino per km², the lowest in Africa, which is influenced by the variable geology and its impact on soil development, the vegetation types and access to water.

The area also has very low (<150 mm per annum), unreliable and patchy rainfall. This is compounded by human-induced disturbance, chance events and demographic effects in small sub-populations (Hearn 2003).

The Palmwag and Etendeka Concessions have approximately 70% of the population, 21% occur in Torra Conservancy and the remainder are found on the neighbouring conservancies. The population has steadily grown over the past 15 years but the annual growth rate has declined. The population's growth rate has been 3.27% per annum since the decline in the 1970s and early 1980s, which is well below the national target of five per cent.

In the 1990s, high calf mortalities were recorded in some parts of the region with Doro!Nawas Conservancy experiencing the highest rate. This was attributed to lack of permanent waters in the area but disturbance by tourism was also suspected as there were high levels of four-by-four vehicles entering the area (Hearn 2003; Sibalatani 2004; Save the Rhino Trust 2005).

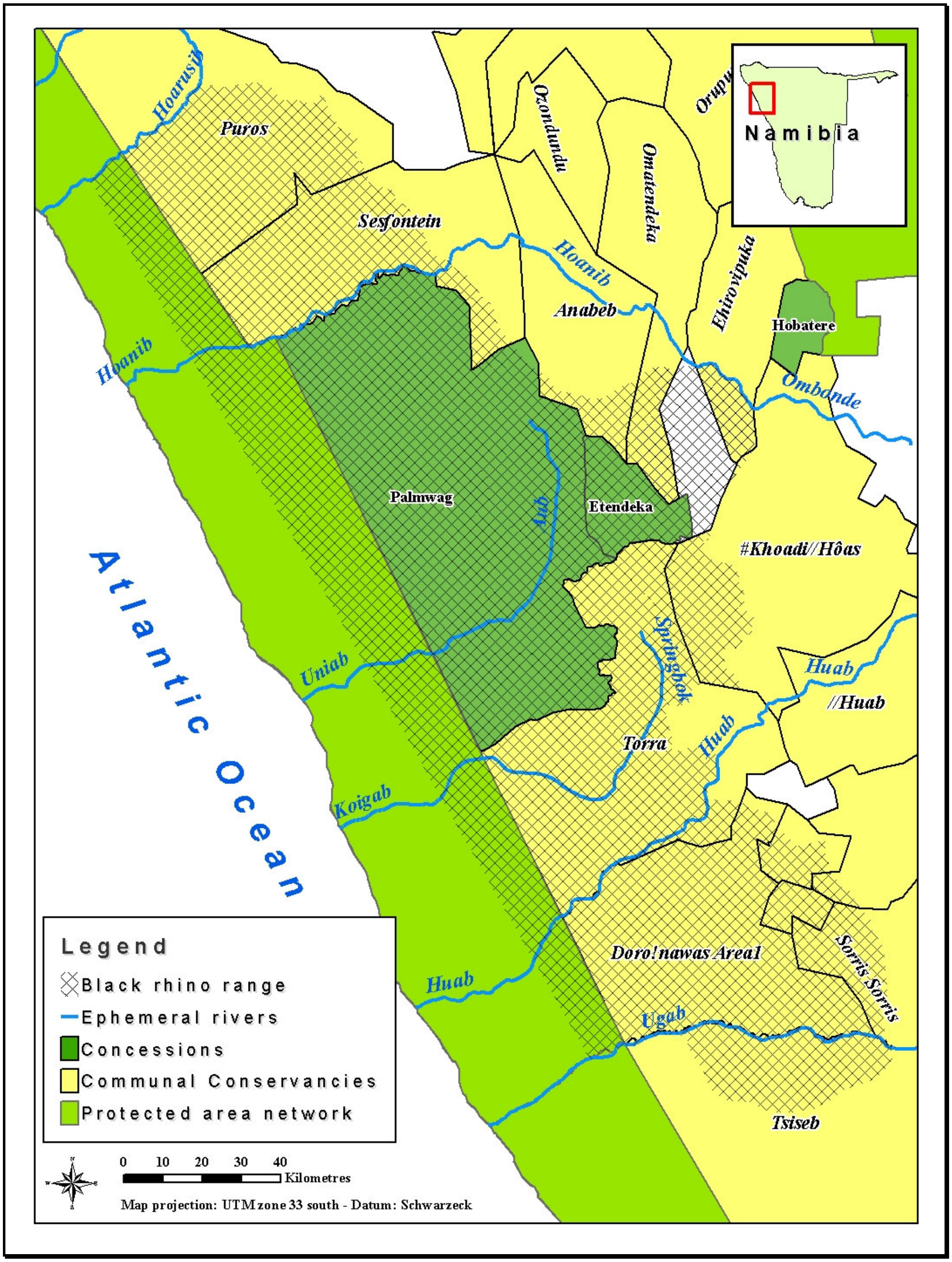


Figure 2.4: Black rhino range outside protected areas in the Kunene region

2.9 Human-induced disturbance (HID) of black rhinos

Biodiversity is facing competition from humanity for space and resources, resulting in many species coming into conflict with people which in turn causes disturbance to animals. Large mammals such as rhinos and large carnivores are bearing the brunt and are either critically endangered or declining rapidly (Walpole *et al.* 2003).

HID occurs when the impact of an animal's response to human presence causes an overall decrease in fertility or increase in mortality. HID is therefore defined as any activity that constitutes a stimulus sufficient to disrupt the normal activities and/or distribution of a species relative to the situation in the absence of that activity (Hearn 2003). The level of threat caused by HID is related to the amount of alternative habitat available or the chance of habituation to humans. Animals that are displaced from their preferred habitat to less optimal habitats can be negatively affected by lower levels of individual survival and fecundity and this could lead to decreases in overall population size. If no suitable habitat is available animals will be forced to remain despite the disturbance and the adverse effects that this will cause (Hearn 2003). Disturbance effects in response to the presence of humans could include:

- Increased vigilance time;
- Seeking cover within home ranges and taking flight;
- Increased movement in an enlarged home range;
- Becoming nocturnal and wary;
- Leaving preferred areas; and
- The expenditure of more energy as a result of increased stress and movement (Recarte, Vincent & Hewison 1998; Wolfe, Griffith & Gray 2000; Tuyttens & Macdonald 2000).

The desert-adapted black rhino, *Diceros bicornis bicornis*, is a shy animal which shuns areas where there is a lot of human activity, instead seeking secluded areas less inhabited by humans and their livestock (Loutit 1996). This statement is supported by Hofmeyr *et* *al.* (1975: 36) who assert that "The activities of rhinos were found to be dependent on several factors, the most important being; human interference, the availability of water and suitable feeding areas." The Kunene region of Namibia is one of the country's tourist hot-spots. Tour operators, guides and self-drive travellers frequently visit the area in search of the desert-adapted black rhino, elephant and lion, as well as the unique landscape and local communities. Lodges offer four-by-four vehicle excursions and operators also advertise scenic flights over the area. These activities quite likely cause disturbances to black rhinos. An example of this occurred in the Masai Mara National Reserve, Kenya, where there was a deterioration of the environment as a consequence of excessive, off-road driving by thousands of tourist vehicles each year. This resulted in an increase in the size of black rhino home ranges (Morgan-Davies 1996).

Local communities can also cause disturbances by their livestock and hunting activities. Livestock cause disturbances by their presence or their competition for resources. The presence of cattle has been shown to have negative impacts on black rhino distribution in the Masai Mara in Kenya where rhinos were displaced from areas where cattle were present or where they tended to avoid such areas (Morgan-Davies 1996; Walpole *et al.* 2003). In the Kunene region of Namibia, where food and water resources are sparse and dependent on rainfall, livestock can compete with wildlife for resources. The periodic droughts in this area make competition with livestock for food and water a particular problem for wildlife (Joubert & Eloff 1971).

The consumptive use of wildlife is another potential form of HID. Conservancies are given user rights over huntable game (*e.g.* oryx, kudu, springbok) depending on game counts conducted the previous year. These rights include: the capture and sale of game, trophy-hunting, own-use hunting and the right to apply for permits for the use of protected and specially protected game (Hearn 2003).

HID could lead to habituation to humans, which has occurred in other rhinoceros species, but these other species do not occur at low densities in an arid environment. The arid environment of the Namibian north-west is scarcely resourced and there are no alternative habitats available for rhino that have abandoned their home ranges due to disturbance (Hearn 2003). Berger & Cunningham (1995) found that interaction between humans and the Namibian north-west black rhino population resulted in flight by males (33%), solitary females (58%) and cows with calves (59%). Rhinos were recorded moving up to 40 km after detecting human presence. As a result, this black rhino population is deemed highly susceptible to HID.

2.10 Summary and Conclusions

It is clear from the literature that there are numerous views on tourism as a subject but that it is indeed a noteworthy academic subject. Tourism is the fastest growing industry in the world and has enough economic importance to impact upon economies, environments and societies and thus deserves academic consideration. It is also one of the few industries that is actually suited to more remote rural areas lacking infrastructure, where there are few other job opportunities (Wunder 2000). The main focus of the above literature review was on nature-based tourism and where it fits into the subject of tourism. It is clear that the most sustainable forms of tourism are nature-based tourism and especially ecotourism. The sustainability of tourism is the primary reason why it is seen as the salvation of Africa. The rapid growth of the tourism industry has brought a number of benefits as well as costs. Larger numbers of people mean more money but they could also imply adverse effects on the environment.

There is a reciprocal impact between ecotourism and the environment. Ecotourism and the environment are linked and dependent on each other. The environment could benefit ecotourism through revenue and the alleviation of poverty, and ecotourism could detrimentally impact the environment through disturbance or destruction. The costs of ecotourism could be reduced by advocating responsible tourism, which is environmentally friendly and advantageous to local communities.

Community-based tourism can generate support for conservation among communities as long as they see some benefit accruing and if it does not threaten or interfere with their main source of livelihood. CAMPFIRE is an example of a failed community-based venture which had the potential to improve the livelihood of rural communities in Zimbabwe. CAMPFIRE failed because of key structural and political issues. The local communities did not receive all the revenue they earned from community-based tourism and political instability affected the tourism market in the country.

In contrast, Namibia is politically stable and it has the right community-based programme in place. Namibia's tourism strategies recognize that most of the country's tourism potential is on communal lands and that broader participation in the industry and its profits is essential if tourism and the wildlife base are going to gain the popular support they need (Ashley 1995). Previous attempts to exclude people from managing natural resources in Namibia were unsuccessful and it became clear that a new strategy was needed to embrace both the needs of the people and the country's international conservation obligations (Davis 2001). Namibia's CBNRM programme is the result of these failures. Zimbabwe's CAMPFIRE programme had the most influence on the development of the Namibian programme. One difference between CAMPFIRE and Namibian conservancies is that a conservancy retains all the income it earns. The programme grants local communities the right to decide their own future through various nature-based tourism ventures. The rights of conservancies over wildlife mean that they are able to generate financial benefits from safaris and trophy hunting.

Concessions play a significant part in Namibia's CBNRM programme. Concessions create opportunities for business development and the economic empowerment of formerly disadvantaged Namibians through access to tourism, hunting and industry based on wild plant and animal resources. Concessions are a powerful mechanism to enhance tourism development and sustainable resource management at regional and national level. The Wilderness Rhino Camp in the Palmwag Concession Area is an example of such sustainable resource management – the occurrence of black rhino, responsible rhino-tracking, and a successful tourism venture.

The black rhino population of the Kunene region in Namibia is an example of the link between responsible tourism and the environment. The population serves as a strategic flagship resource both for the conservation of biological diversity and for improving livelihoods through ecotourism in communal conservancies in Namibia (Save the Rhino Trust 2005). Black rhinos have been hunted to the brink of extinction for their horns and they are only recovering because of the high value placed on them. Their value is realized through consumptive and non-consumptive use. To date, Namibia has only used black rhinos non-consumptively through live sales and tourism. Tourism is seen as the best option to benefit local communities and to protect the sub-species. The Ministry of Environment and Tourism's national black rhino strategy (Namibia 2003b) states that benefits derived from the presence of rhinos can stimulate communities to improve monitoring efforts and protect these animals, which in turn will increase the values that communities place on wildlife resident in conservancies in communal land. However, the strategy also states that any forms of human disturbance negatively impacting rhino behaviour, conditions and breeding performance need to be eliminated or kept to an absolute minimum if black rhino conservation is to succeed. The conservation of black rhinos is based on the need to prevent extinction due to human-induced changes and to maintain the evolutionary potential of the species (Du Preez 2000).

The main question that stems from the literature is: what is the reciprocal impact between ecotourism in a pristine natural environment, such as the Kunene region in Namibia, and an important flagship species such as the black rhino? There is a need to research this question because Shultis & Way (2006: 231) contend that: "Despite the understanding that tourism developments affect wildlife, there is limited research in this area." This thesis addresses this gap. The research design and methodology are discussed in the following chapter.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

After an in-depth literature study, deductive reasoning was used to identify the problem, define central concepts, formulate hypotheses and to select and construct the appropriate measuring instruments

It was evident from the literature review that key questions need to be answered about the reciprocal impacts of ecotourism and important flagship species, such as the black rhino. To answer these questions two hypotheses will be investigated quantitatively.

Evaluation forms on human-induced disturbance were completed concerning 24 transmitter-fitted black rhinos, as well as any other rhinos encountered during the field work. Global positioning system (GPS) points were registered through direct observation and from the air to determine the home ranges of the identified rhinos. Additional SRT fixes were also taken by the SRT field staff after the researcher left the study area[1]. The GPS points were collected from late March 2006 until late January 2007.

Questionnaires were designed for completion by tourists visiting the study areas to assess their willingness to undertake rhino tracking with the use of telemetry and local trackers. Information on the level of satisfaction of tourists who have undertaken rhino-tracking was collected through questionnaire surveys. This chapter describes the testing of the hypotheses.

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[1] The researcher left the study area in August 2006. SRT continued to monitor the transmitter-fitted rhino through aerial surveillance up to the end of January 2007.

3.2 Research design

A quantitative approach was followed in which hypotheses were tested by examining the relationship (impact) between ecotourism and black rhino as an endangered species. The research design is depicted in Figure 3.1.

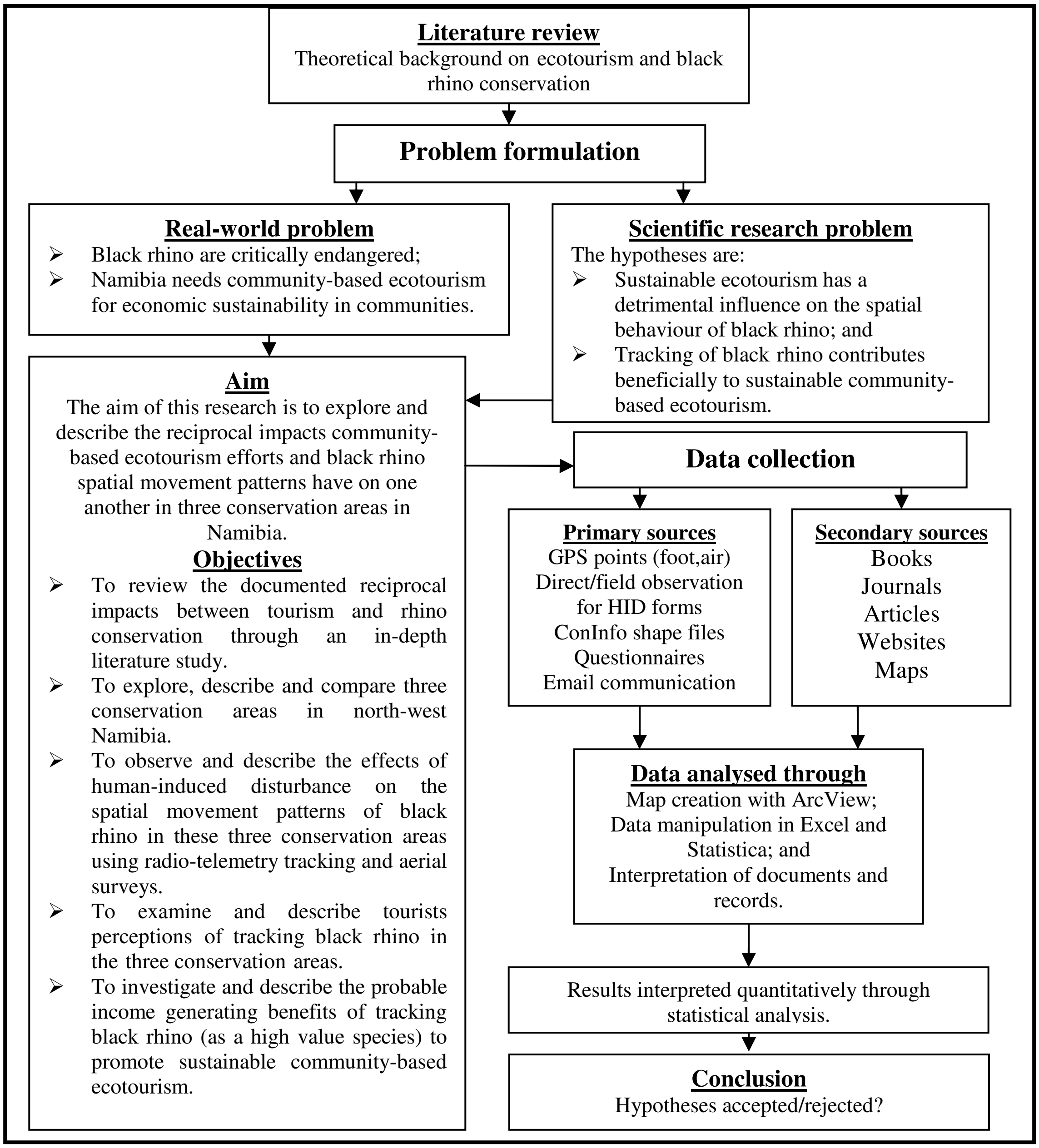


Figure 3.1: Research design of this thesis

The research starts with a literature review on ecotourism and black rhino conservation. The literature study raised research problems. The problem formulation states real-world problems and asks scientific questions. The real-world problem focuses on the fact that black rhinos are critically endangered and that a Third-World country, such as Namibia, needs community-based ecotourism for sustainable economic development. Two hypotheses were formulated to answer the stated research questions. The real-world and scientific research problems generated the overarching aim and objectives of the research.

The research was conducted as field research. Sarantakos (2005: 202) describes field research "as the systematic study of ordinary events and activities as they occur in real-life situations." Data collection involved quantitative data collection methods. Quantitative data collection involves responses from a large number of informants, which is necessary for valid statistical analysis (D'Cruz & Jones 2004). The data collection techniques focused on observations and surveys. Physical observation which focuses on objects as part of the physical environment was used. Questionnaire surveys were undertaken.

Reaching the five objectives meant that primary and secondary data sources were needed. Primary data collection methods included the:

- Use of SRT trackers and telemetry equipment to register GPS positions for 24 rhinos fitted with transmitters. Aerial surveying to collect additional GPS points was conducted with the help of an SRT pilot;
- Completion of human-induced disturbance forms/records through direct field observation using a telemetry device and SRT trackers concerning 24 rhinos fitted with transmitters, or any others that were encountered;
- Acquisition of CONINFO (Central CBNRM Computer Database) shape files for digital-mapping;
- A questionnaire survey of tourists visiting the study areas; and

- Email communication with managers of the targeted lodges to enquire about tourist numbers and occupancy rates.

Secondary data needed to supplement the primary data sources, were gathered from the World Wide Web, the J.S. Gericke library at Stellenbosch University and the Ministry of Environment and Tourism of Namibia. Secondary data sources included books, journals, websites, maps and e-mails.

The primary and secondary data were analysed quantitatively using computer software. According to Mouton (1996) in a quantitative research approach the analysis of data refers to the stage in the research process where the researcher, through the application of various statistical and mathematical techniques, focuses separately on specific variables in the data-set. Researchers analyse data to understand the various constitutive elements through an inspection of the relationships between concepts, constructs or variables, and to see whether there are any patterns or trends that can be identified or isolated, or to establish themes in the data (Mouton 2001).

Data were captured in Excel and Statistica 7.0 for statistical analysis. Data were manipulated and analysed using Excel, Statistica 7.0 and geographic information system (GIS). GIS was used for the analysis of spatial data and Demers (2000) and Clarke (2003) were consulted in this regard. GIS effectively refers to the hardware, software and personnel used for storage, manipulation and analysis of spatially referenced data (Walpole 2000). GIS are tools for collecting, storing, transforming and displaying spatial data for a particular set of purposes to make decisions about some portion of the earth (Demers 2000; Clarke 2003; Lipp 2005).

Rhino conservation is based on security and biological management (Emslie & Brooks 1999). These issues rely on information about the geographical locations of rhinos and why they are in those areas. Thus, there is a distinct spatial element that makes data storage, presentation and analysis using GIS an appropriate approach. GIS makes it possible to examine how rhino-use of an area has changed with changing habitat or through human intervention by tourism, for example (Walpole 2000). GIS was used in the analysis of the home ranges for the rhinos and in the comparison of the different study areas. The shape files used were acquired from the CONINFO database of ICEMA (Integrated Community-based Management Projects). The Central CBNRM Computer Database is a data management tool for storing and managing conservation-related data. It comprises three main data types: databases and spread sheets, GIS data and image data. It is a data management structure containing core data for conservancies, concessions, protected areas and other conservation areas in Namibia.

The results from the data analysis were interpreted to reach conclusions. The conclusions were used to test whether the two hypotheses were to be accepted or rejected. The following sections describe some of the research instruments, used to gather the required data.

3.3 Rhino-monitoring techniques as research instruments

A telemetry set was used to locate the rhinos with the transmitters implanted in their horns. Once the rhinos were located, human-induced disturbance forms were completed and a GPS was used to mark their position. Aerial surveying was also conducted and GPS points taken.

Black rhinos are critically endangered and require constant monitoring. Monitoring is the process of observation over time to detect changes, if any. Monitoring can include observing ecological variables such as species and ecosystems, as well as socio-cultural variables such as knowledge, attitudes and practice that influence and define human and environmental interactions. The goal of monitoring is to identify the status and trends in resources of interest which will lead to a better understanding of these resources. The information gained from monitoring provides managers with the necessary data to improve understanding of factors affecting population performance, such as breeding rates, mortality, rhino distribution, social behaviour, density and dispersal patterns (Emslie & Brooks 1999; Pitlagano 2007).

Twenty-four black rhinos were immobilized and their horns implanted with transmitters during March 2006. The rhinos were anesthetized during the immobilization process. The immobilization of the rhino took place from a helicopter with a dart gun. The rhinos were darted by Dr Pete Morkel during the operation and the approximate time of immobilization was one hour. The implants were the first stage in the eventual translocation of these animals. The translocations were aimed at dispersing the desert-adapted black rhino into their historic range, namely in recently proclaimed community conservancies of north-west Namibia (Namibia 2003b). The first step of the research was the fitting of transmitters for easy location of the rhino in the future.

3.3.1 Fitting of transmitters

Twenty-four rhinos were each fitted with a transmitter for research purposes. Transmitters were implanted in the horns as horn implants are generally considered the best option. (Hofmeyr 1998; Shrader & Beauchamp 2001; Morkel & Kennedy-Benson 2004). A hole, slightly bigger than the transmitter, was drilled in the side of the horn (see Figure 3.2).

Figure 3.2: Drilling a hole in the side of a rhino's horn for transmitter implantation

The tip of the horn was cut off to implant the transmitter antenna as the hole for the antenna was drilled from the top of the horn. The hole was drilled down the length of the horn from the flattened tip to the transmitter hole. Horn size is important when implanting transmitters. Short horns reduce the leverage on the base of the horn and there is a possibility that the rhino could knock it off afterwards (Morkel & Kennedy-Benson 2004). The transmitter was secured and sealed using dental acrylic as indicated in Figure 3.3.

Figure 3.3: Dental acrylic used to seal a transmitter in the rhino's horn

Depending on a number of factors, including the size of horn, position of transmitter and battery life, a horn transmitter works for six months to two and a half years (Morkel & Kennedy-Benson 2004). The duty cycle of the transmitters was set from 06:00 to 18:00 to extend battery life. Each transmitter also has a mortality sensor which changes the pulse rate of the signal from an "active" rate to an "inactive" rate if the animal has not moved and the transmitter becomes dormant for a certain number of hours (Du Toit 1996). A transmitter is about the size of a matchbox (see Figure 3.4).

Figure 3.4: Transmitter and it's antenna compared to a matchbox for size

During the fitting of the transmitters biological samples were taken and characteristic ear patterns were photographed while ear notches were clipped and a transponder chip was inserted into the neck of the animal. The transponder is a microchip that is implanted under the skin or in the horn to aid in identification, and is about the size of a grain of rice. The chips can only be read from a very short distance by scanning the body and are mainly used to identify carcasses, horns or an immobilized rhino (Du Toit 1996; Morkel & Kennedy-Benson 2004). The telemetry equipment was checked at each rhino to ensure that the transmitter and receiver were working and that the frequency was correct.

3.3.2 Use of GPS and telemetry

Rhino locations were recorded in the field using a GPS unit (Garmin GPS 12XL) which is a worldwide satellite-based navigation system formed from a constellation of twenty-four satellites and their ground stations. These satellites orbit 12 000 m above the earth twice a day and send radio signals from space which GPS receivers convert into position, velocity and time estimates. Most receivers can locate a position within an accuracy level of between 15 and 20 m (GARMIN 2007). The map datum on the GPS was set to Schwarzeck and the units to metric. GPS locations were also taken from an aircraft, a Cessna 182, used by SRT to monitor rhinos (Figure 3.5). This was done at an altitude of more than 1000 feet above ground and by comparing the signals received by the aerials mounted on each wing. It was sometimes necessary to fly an S-shaped pattern until one of the aerials pointed directly towards the transmitter. The aircraft circled above the animal until the signal was at its strongest and then the GPS point was taken.

Figure 3.5: Aircraft used for aerial surveying of rhinos

A telemetry device was used for easy location of the rhino (Figure 3.6). Activity patterns are often described by using radio-tracking data and are an excellent tool for gathering data on the biology of animals and their interactions with the environment (Salvatori *et al.* 1999). The monitoring of animal movements by radio-tracking provides useful data on the behaviour of individuals, particularly those living in closed environments or having nocturnal habits. The habitat and nocturnal activities of black rhinos made it necessary to use radio-telemetry equipment to track the animals. The telemetry devices used were a R-1000 telemetry receiver from Communications Specialists with a three-element rubber duck RA-2A directional antenna (Communications Specialists 2007). Signal ranges of 10 km or more can be achieved from elevated points (Du Toit 1996; Shrader & Beauchamp 2001; Du Toit, Brooks & Emslie 2006). Hills were often climbed to obtain optimum range.

Figure 3.6: Telemetry set used for finding rhinos fitted with transmitters

3.3.3 Monitoring human-induced disturbance

Human-induced disturbance (HID) occurs when the impact of an animal's response to human presence causes an overall decrease in fertility or increase in mortality of the animals. HID is defined as any activity that constitutes a stimulus sufficient to disrupt the normal activities and/or distribution of a species relative to the situation in the absence of that activity (Hearn 2003). The monitoring of HID in north-west Namibia is an ongoing project carried out by SRT and Round River Conservation Studies and it is aimed at assessing the long-term sustainability of tourism on rhinos in the Kunene region.

The monitoring of HID for this research commenced in May 2006 and was concluded in August that year. The HID forms were completed by tracking the rhino on foot with the help of radio-telemetry and local SRT trackers (see Appendix C). Rhino monitoring conducted on foot is considered the most reliable form of monitoring (Walpole 2002). Evaluation forms were completed by the researcher while directly observing the rhino. Forms were completed for both transmitter-fitted and non-fitted rhinos. Only one form was completed per group of rhinos observed and rhinos fitted with radio transmitters were not located more than once daily in order to reduce autocorrelation of relocations. The researcher had no research assistant and therefore had to complete the HID forms personally. During the completion of the HID forms, SRT identification forms for black rhinos were also completed (see Appendix B). The identification forms are used by SRT to keep records of rhinos and for monitoring purposes. The identification forms were complemented by photographs for later analysis by SRT. Eighty-eight HID forms were filled in for the twenty-four rhinos fitted with transmitters and the non-transmitter fitted animals during the research period.

3.3.4 Determining home range

A common definition had to be decided on for home range in order to determine the rhino's home ranges. Burt (1943: 351) describes a home range as "…that area traversed by an individual in its normal activities of food gathering, mating, and caring for young. Occasional sallies outside the area, perhaps exploratory in nature, should not be considered part of the home range." Osborn (2004) states that the range assessment for relatively long-lived and highly mobile animals are 'snapshots' and do not represent all the places they have traversed in their lifetime. Home range is thus viewed as the sum of an animal's movements with a focus on the spatially distributed resources that structure an animal's movements. Home range was indicated by using GPS locations for the identified rhinos. Using a GPS unit, the location of the rhinoceros sightings from March 2006 to January 2007 were plotted on a map of the study areas.

Data were processed in Microsoft Excel and imported to Arcview 3.3. The Animal Movement Analysis Arcview extension (Hooge & Eichenlaub 1997) and the home range extension for Arcview (Rodgers & Carr 1998) were used in all GIS analyses to estimate the home ranges. According to Rodgers & Carr (1998) home range analysis models can be classified into four fundamental different approaches namely minimum convex polygons, bivariate normal models (Jennrich-Turner estimator, weighted bivariate normal estimator, multiple ellipses and Dunn estimator), nonparametric models (grid cell counts, Fourier series smoothing, harmonic mean), and contouring models (peeled polygons, kernel methods, and hierarchical incremental cluster analysis). The minimum convex polygon (MCP) and the kernel methods were used in this study to estimate home range. The latter method was used to indicate the core areas of activity and the former method to calculate the areas occupied.

Kernel density calculates the density of features in a neighbourhood around those features. A smoothed curved surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the search radius distance from the point. Only a circular neighbourhood is possible. It is based on probability kernels which are regions around each point location containing some likelihood of animal presence. The volume under the surface equals the population field value for the point, or one if none is specified. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell centre (Silverman 1986). The method describes the probability of finding an animal in any one place. The 95% kernels were used to estimate home range and the 50% kernels as an estimate of core-use area (Moser & Garton 2007). Kernel home range estimates were not used as a statistical home range estimator due to the small point sample size. Druce *et al.* (2006) state that kernel home ranges require at least 30 points to indicate accurate home range estimates.

The MCP method is the simplest way to estimate the size of a home range. It is calculated by drawing a polygon that encloses all the points or a percentage of the points to estimate the area in the polygon (Osborn 2004). The MCP is created around a set of points so that the line of the polygon goes around the outside edge of the set of points. It is called a convex polygon because it has no interior angles greater than 180° and it is called a minimum convex polygon because it is the smallest polygon that fits the convex conditions (Rodgers & Carr 1998). The MCP's of individual rhino were used to determine estimated home range sizes. The MCP was chosen to allow comparisons with other home range studies. Ten locations were deemed necessary to measure the estimated home range for individual rhinos (Hearn 2003). The MCP approach also suffers from sample size effects and is greatly affected by outliers which contain much of an area that is never used by an animal. Removing a certain percentage of points, such as 5%, can mitigate the outlier effect (Hooge & Eichenlaub 1997). Therefore the 95% MCP method was used. The "fixed a mean" function was used in calculating the 95% MCP home ranges for the rhinos. This method calculates the arithmetic mean of the entire x (longitude) and y (latitude) coordinates, and then selects the requested percentage of points closest to that arithmetic mean point (Rodgers & Carr 1998).

3.4 Tourist survey about rhino-tracking

A questionnaire survey of tourists visiting the study areas was undertaken to assess the likelihood of tourists wishing to conduct rhino-tracking on foot through the use of telemetric equipment and local trackers (see questionnaire in Appendix D). Semi-standardized questionnaires were used because:

- Questionnaires surveys are less expensive than other research methods;
- Results are produced quickly;
- Respondents complete the questionnaires at their own convenience;
- They offer greater anonymity;
- Bias or errors caused by the presence or attitudes of the interviewer are reduced;
- They allow a wider coverage, because respondents are more easily approached than by other methods; and
- The problem of availability of respondents (a common problem in interviewing) is eliminated (Sarantakos 2005).

Semi-standardized questionnaires include a combination of pre-structured and pre-standardized questions and of unstructured and unstandardized parts. The questionnaire had a covering letter to introduce and explain the research to respondents (De Vos *et al.* 2005; Sarantakos 2005). The covering letter included all necessary information and motivated respondents to complete the questionnaire. The contact details, purpose of study, beneficiaries of study, an appeal for cooperation, how long it would take a respondent to complete the questionnaire and assurance of anonymity and confidentiality were included in the questionnaire as stipulated by De Vos *et al.* (2005).

The questionnaires sought information about the financial benefits that tracking could have for black rhino conservation and local development. Further questions enquired about safe viewing distance, intended length of stay in the region and reasons for visiting the area. The questionnaire was divided into two sections. The first was aimed at tourists who have never done rhino-tracking, and the second at tourists who have done rhino-tracking before. The questionnaire contained various types of questions, namely;

- Open questions in order to give respondents the opportunity of writing their own answer in the open space;

- Dichotomous questions providing Yes/No questions that were followed by further response options;
- Completion questions which were used to determine variables;
- Multiple-choice questions which were included to determine distance and time measurements; and
- Scaled questions which were used to determine the respondents' level of experience (Neuman 1997; De Vos *et al.* 2005).

A total of 400 questionnaires was distributed to the lodges in the study areas from June to August 2006. These three months represented the only period available for monitoring the process of completing and receiving questionnaires from the lodges. The 400 questionnaires distributed represented 2.5% of the total number of guests (16131) who visited the study area during the period March 2006 to February 2007 as reported by Wilderness Safaris and Grootberg Lodge. Questionnaires were distributed to the Grootberg Lodge (100) in the #Khoadi-//Hôas Conservancy, to the Damaraland Camp (100) in the Torra Conservancy, to the Palmwag Lodge (150) as well as to the Rhino Wilderness Camp (50) within the Palmwag Concession Area questionnaires were given to receptionists and staff to distribute among tourists. A 50% response rate was achieved with 200 questionnaires being completed. The final response rate in terms of the total number of guests who visited the study area between March 2006 and February 2007 was therefore less than 1%. Unfortunately, it was impossible to determine the response rate for the three-month period when the questionnaires were in circulation because of a lack of detailed visitor data for the lodges in question.

3.5 Limitations of the data

There are a number of possible limitations to the data. The main limitations concern the monitoring of the black rhino and the determination of home ranges. Black rhinos are extremely shy and secretive and gathering conclusive evidence on their home ranges is problematic. The transmitters fitted in the rhino horns represent delicate equipment that can easily fail or give weak signals. Some of the gaps in the data regarding monitoring are listed below.

- A number of transmitters provided weak signals and were difficult and sometimes impossible to find. This could have been caused by shortened antennae which reduce the range of the transmitters (Shrader & Beauchamp 2001).
- Transmitter-fitted animals could not be tracked regularly, making comparisons of the distances between fixes difficult or even superfluous as periods between tracking varied from days to a week. This was mainly due to the vastness and inaccessibility of the area being researched.
- Minimum convex polygons do not give an accurate idea of the actual area important to the animal. They give an indication of the total area that an animal may use but this tells nothing of how the range is used (Whyte 1993; Lawson & Rodgers 1997). The kernel method for determining the sizes of home ranges was not used due to a lack of GPS points per animal.
- Radio telemetry data were only collected during daylight hours as opposed to 24-hour sampling. This could cause bias in estimates of the utilization distribution, suggesting high use in areas used during diurnal periods and low use during nocturnal periods.
- The home ranges were determined for a period of only 10 months. This could be inconclusive for determining the actual home ranges because definitive home range determination requires data for an extended period so as to include factors such as seasonality, breeding cycles and droughts. Osborn (2004) states that some animals may regularly shift their ranges in response to environmental conditions and in accordance with social behaviour.

Difficulties were encountered in collecting the questionnaires. The main problem cases were Grootberg Lodge and Damaraland Camp. Grootberg Lodge had a 26% response rate, Damaraland Camp only 10% and Rhino Wilderness Camp 34%. This contrasts sharply with Palmwag Lodge's response rate of 73.5% thus constituting an under-representation of Grootberg Lodge, Damaraland Camp and Rhino Wilderness Camp's visitors. Being stationed at Palmwag Lodge where the SRT camp is situated, the researcher was able to monitor the responses to the survey there, but was unable to do so with the other three lodges on account of the extreme distances to these locations.

CHAPTER 4: HUMAN-INDUCED DISTURBANCE TO KUNENE BLACK RHINOS

4.1 Introduction

The vulnerability of an animal to disturbance depends on its life-history traits and evolutionary strategies such as longevity, degree of parental care and reproductive efforts. Human-induced disturbance (HID) can be detrimental to the conservation success of the northwestern Kunene black rhino population. HID is a matter of grave concern since it can impact on survival and fertility, hence causing the population to decline. Disturbances could potentially cause black rhino to avoid or underutilize areas in response to human presence which is equivalent to the loss and degradation of its habitat (Gill & Sunderland 2000; Newsome, Dowling & Moore 2002).

The scientific approach to measuring the impacts of disturbance should include knowledge of:

- Social behaviour;
- The animals' natural movements and use of various areas;
- Critical habitat requirements;
- An assessment of life-history parameters (reproductive fitness and survival rates); and
- Responses to tourism pressure and activity (Newsome, Dowling & Moore 2002).

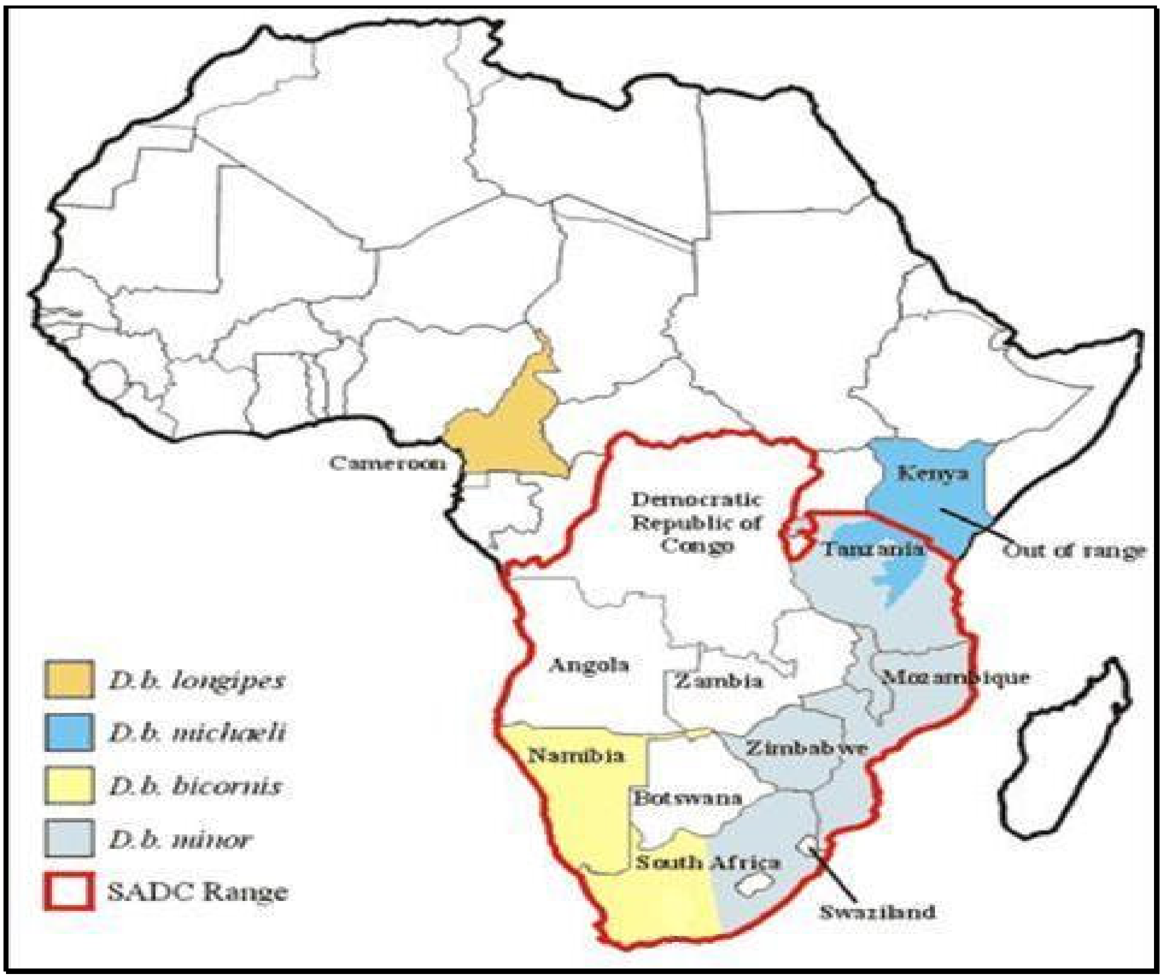
This chapter presents and interprets the results of the application of the various research techniques and instruments discussed in the previous chapter. The literature review indicated a paucity of research on the reciprocal impacts of ecotourism and black rhino conservation. Here an attempt is made to shed more light on the interrelationship by testing the first of the two hypotheses, namely that sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos. The hypothesis will be tested using data on black rhinos recorded on HID forms. Black rhino behaviour and responses to the presence of human activities were considered to accept or reject the hypothesized relationship. The following section presents information derived from the literature on black rhino biology and behaviour.

4.2 The black rhino

Adult black rhinos weigh up to 1 600 kg and stand 1.4 m to 1.6 m at the shoulder. They are distinguishable from white rhinos by their smaller size, lack of a nuchal (neck) hump and the smaller head, which is carried high, features which present a different silhouette. Black rhinos are also distinguishable from white rhinos by their triangular-shaped, prehensile upper lip. Black rhinos have two horns made of keratin on the rostrum, one in front of the other, and they have a very thick (up to 32 mm), gray skin with deep folds. The black rhino's body is characteristically heavy and stocky, with a short neck and a large head, and it is almost hairless. The species has three hoofed toes; the central toe is the largest and takes most of the animals' weight. The tail is small with a tuft of hair at the tip. Black rhinos have very poor eye-sight, but a good sense of smell and excellent hearing, which sometimes make them dangerous if cornered or if encountered during mating season. A black rhino lives to about 40 years of age with males reaching maturity at age eight and females at six. A female's gestation period is approximately 15 months, with an inter-calving period of about two and a half to three years (Du Preez 2000; San Diego Zoo Library Fact Sheets 2003; Slattery 2003; Morkel & Kennedy-Benson 2004; Namibia 2009).

4.2.1 Taxonomy of the black rhino

The black rhino, *Diceros bicornis*, is part of the Rhinocerotidae family, one of the three surviving families in the order Perissodactyla (odd-toed ungulates). The other two surviving families are the Equidae (horses, zebras and asses) and the Tapiridae (tapirs). Consequently, black rhinos have a lot in common with horses regarding anatomy, physiology, parasites, disease, nutrition and response to drugs (Morkel & Kennedy-Benson 2004). The AfRSG of the International Union for the Conservation of Nature and Natural Resources (IUCN) subdivides black rhinos into four main subspecies or ecotypes according to the habitat in which they occur, as shown in Figure 4.1.



(Source: SADC Regional Programme for Rhino Conservation 2005)

Figure 4.1: Distribution of black rhino subspecies in Africa

The detailed taxonomy of the black rhino is as indicated hereunder.

- Describer (Date): Linnaeus 1758 (*Diceros bicornis*)
- Kingdom: Animalia
- Phylum: Chordata
- Class: Mammalia
- Order: Perissodactyla
- Suborder: Ceratomorpha (rhinos and tapirs)
- Family: Rhinocerotidae
- Genus: *Diceros*
- Species: *Diceros bicornis* (black rhino)
- Subspecies/Ecotypes: *D. b. longipes* (western black rhino)
  D. b. michaeli (eastern black rhino)
  D. b. bicornis (south-western black rhino)
  D. b. minor (south-central black rhino)

(Emslie & Brooks 1999; San Diego Zoo Library Fact Sheets 2003; WWF 2006).

4.2.2 Black rhino habitat requirements

The SADC Regional Programme for Rhino Conservation (2005) defines a habitat as the place where an animal or a plant chooses to live and where all its requirements are met. Black rhinos are present in habitats ranging from desert in south-western Africa to montane forests in Kenya, usually in grassland-forest transition zones. Major habitat types include tropical and subtropical grasslands, savannahs, and shrublands; deserts and xeric shrublands (WWF 2006). Riverine habitats are favoured by black rhino. Hearn (2003: 39) found that in the Kunene region "Riverine habitats had much greater spoor densities than either plains or slopes." The wide variety of habitats in which black rhino still occur, and the variety of plant species utilized, is a reflection of their adaptability.

4.2.3 Black rhino diet

The prehensile lip of the black rhino allows it to specialize on a different diet from that of the white rhino. The black rhino is mainly a browser, but does consume grass on occasion. The San Diego Zoo Library Fact Sheets (2003) describes a browser as an animal that eats leaves, twigs and branches. The black rhino feeds on woody twigs and legumes with high moisture content and has a predilection for *Acacia* species. The method of feeding is distinct as it clips off browse (twigs and shoots) to leave a scissor-like cut stem. Browse height is an important factor in black rhino diet in that they browse at a height of less than two metres above the ground (Muya & Oguge 2000; Adcock 2001; Birkett 2002).

Seasons influence the diet of black rhinos. Different groups of plant species provide black rhino food in different proportions through the seasons of the year (Adcock 2001). Diversity of plant species is also an important factor. Muya & Oguge (2000: 62) maintain that "a key habitat factor important in black rhinoceros conservation includes diverse plant species…" Up to 220 plant species have been recorded (99 woody, 102 herbs and 25 grasses) as being eaten by black rhinos (San Diego Zoo Library Fact Sheets 2003). Browse utilization varies significantly with availability. Muya & Oguge (2000: 66) point out that: "Black rhinos are confronted with a 'cost' and 'benefit' situation of extreme selection of browse species for utilization against availability, and they have to integrate successfully this relationship in order to survive. The 'benefits' accrued from selectivity might be too expensive energetically to sustain, especially in cases where food resources are not widely available and therefore, browse species which are more available tend to be utilized".

Black rhinos are not susceptible to poisonous tannins that often increase in plants during drought. This is what makes the black rhino population of Namibia unique in that they are adapted to extreme arid conditions (Du Preez 2005, pers comm). One of these desert-adapted black rhino populations is located in the Kunene region. This population is the biggest black rhino population that occurs outside any protected area and it is free-living. They feed on an estimated 74 plant species of the 103 species that are available during the driest time of the year (Achimer Friends of Rhino 2005). Some of the plants that are browsed contain very high levels of soluble tannins which are normally regarded as a chemical defense mechanism by which plants avoid being eaten. *Euphorbia* species are the black rhino's most highly favoured plant species and *Euphorbia damarana* is often browsed by black rhinos for hours on end. The milky sap of this plant is highly poisonous to other animals and humans but black rhinos are impervious to it. *Euphorbia* species, along with other succulent plant species, provide rhinos with water in the absence of free water (Bhima & Dudley 1996; Achimer Friends of Rhino 2005).

4.2.4 Water needs

The black rhino can handle drought conditions well compared to many other animal species and can last for up to five days without drinking water if its food contains sufficient moisture (San Diego Zoo Library Fact Sheets 2003). They normally have to drink every day or every second to third day if they do not ingest sufficient moisture from plants. This makes them water dependent and they are rarely found more than 15 km from water sources (Morkel & Kennedy-Benson 2004).

4.2.5 Climatic conditions

Rainfall impacts on black rhinos in a number of ways. Rainfall variability has an overriding effect on vegetation growth, and hence on food production for large mammalian herbivores in arid and semi-arid environments (Owen-Smith 2001). The diet of the black rhino changes in relation to seasons and rainfall. In the Kunene region, Hearn (2003) found that black rhino density decreased from east to west in response to the rainfall gradient of the area and that rainfall has a lag effect on breeding. Calving is positively correlated with the mean annual rainfall of an area (Hearn 2003). Du Preez (2000: 61) found that “Conception on Waterberg Plateau Park appeared to be seasonal with a peak during April and May and it correlated positively with the preceding rainfall.”

Black rhinos are able to withstand extreme temperatures. In the Kunene region of Namibia, day temperatures can exceed 40º C (Hearn 2003). Very low temperatures can have a negative effect on black rhinos. In the Hardap Game Reserve it was established that a positive correlation exists between months with low temperatures and black rhino mortalities (Namibia 2004). This mortality is associated with wind chill during winter months, when the death of a number of young calves occured on high plateaus. Temperature can also affect the browse of black rhinos with frost causing leaf-loss, sap withdrawal and a drop in browse quality and quantity (Adcock 2001).

4.2.6 Geology and soils

In the Kunene region of Namibia, Hearn (2003) established that black rhino density was the highest in basalt mountainous areas. This area is dominated by schists and marble lying in folds and faults with a westward vergence. The western part of this area has gently undulating rocky and granite plains, with isolated rock outcrops finally giving way to the shifting dunes of the coastal desert (Hearn 2003). Soils in this area consist predominantly of lithosols and other weakly-developed, shallow soils of arid regions.

4.2.7 Black rhino spatial behaviour

The home ranges and territories of animals, and the spatial distribution of animals within a population, are commonly thought to reflect the distribution of one or several limiting resources on a landscape. The home range of an animal must be clearly distinguished from its territory. The home range of an animal is the area occupied by an animal in its normal activities of reproduction and gathering of the necessary resources for survival. A territory is that part of an animal's home range where the animal excludes conspecifics to protect resources or offspring. Territory is the protected part of the home range, be it the entire home range or only the nest. Every kind of mammal may be said to have a home range, stationary or shifting. Only those that protect some part of the home range, by fighting or aggressive gestures, from others of their kind during some phase of their lives, may be said to have territories. Animals with a large body size tend to have large individual ranges and are prone to die off when their range is damaged or fragmented (Burt 1943; Du Preez 2000; Mitchel & Powell 2004). The home range of an animal is determined by:

- The size of the individual and its mobility;
- The quantity and availability of the resources;
- The constancy, or the lack of constancy of the resources; and
- Behavioural considerations associated with territoriality and population density (Du Preez 2000).

Black rhinos, being large-bodied animals, tend to have large home ranges and this is magnified for black rhinos living in the arid north-west Kunene region of Namibia. The population of black rhinos in north-western Namibia is one of the most extreme cases of arid land adaptation. The home range of this population is also determined by the lack of quantity and availability of browse which would be highly seasonal. The seasonal changes in diet can also result in a seasonal shift in habitat use. The differences between sexes regarding home ranges must also be considered. The variations in female home ranges, as a measure of spatial movement patterns, appear to be related to food and water requirements, while male home ranges are governed by the dominant status of the individual (Hearn 1999; Du Preez 2000).

Human-induced disturbance can also cause differences in home ranges or lead to an increase in home range size. Animals affected by human-induced disturbance normally seek alternative home ranges or become habituated. Black rhinos in the north-western

Kunene are especially vulnerable because they occur in low densities in an arid environment and there is relatively little suitable alternative habitat available. The response of a species to disturbance can be similar to predation risk – if there is suitable habitat available with sufficient resources nearby, disturbance may be avoided by movement to these sites. By contrast, animals that have no alternative suitable habitat available will be forced to remain despite the disturbance, even if this will affect survival or reproductive success (Gill, Norris & Sutherland 2001; Shaw 2002).

The black rhinos of the north-western Kunene have significantly larger home ranges than those of other African populations. The density of rhinos in this population has been estimated at 0.001 rhino per km^2 over the entire distribution area and the expected optimal density is not expected to be more than 0.015 rhino per km^2 (Hearn 2003).

The next section reports the results of an analysis of the data collected in the field and recorded in the HID forms.

4.3 Human-induced disturbance of black rhino

The data from 88 HID forms for 24 transmitter-fitted black rhino, as well as other black rhino encountered during the research period, were analysed in three phases.

- The first phase involved pre-viewing data which comprises data gathered before the actual tracking of the black rhino started.
- The second phase looked at viewing data comprising the whole tracking process as well as the environmental factors involved.
- The third phase concerned behavioural data of black rhino behaviour when an animal was located and observed (and it became aware of the trackers).

4.3.1 Pre-viewing data

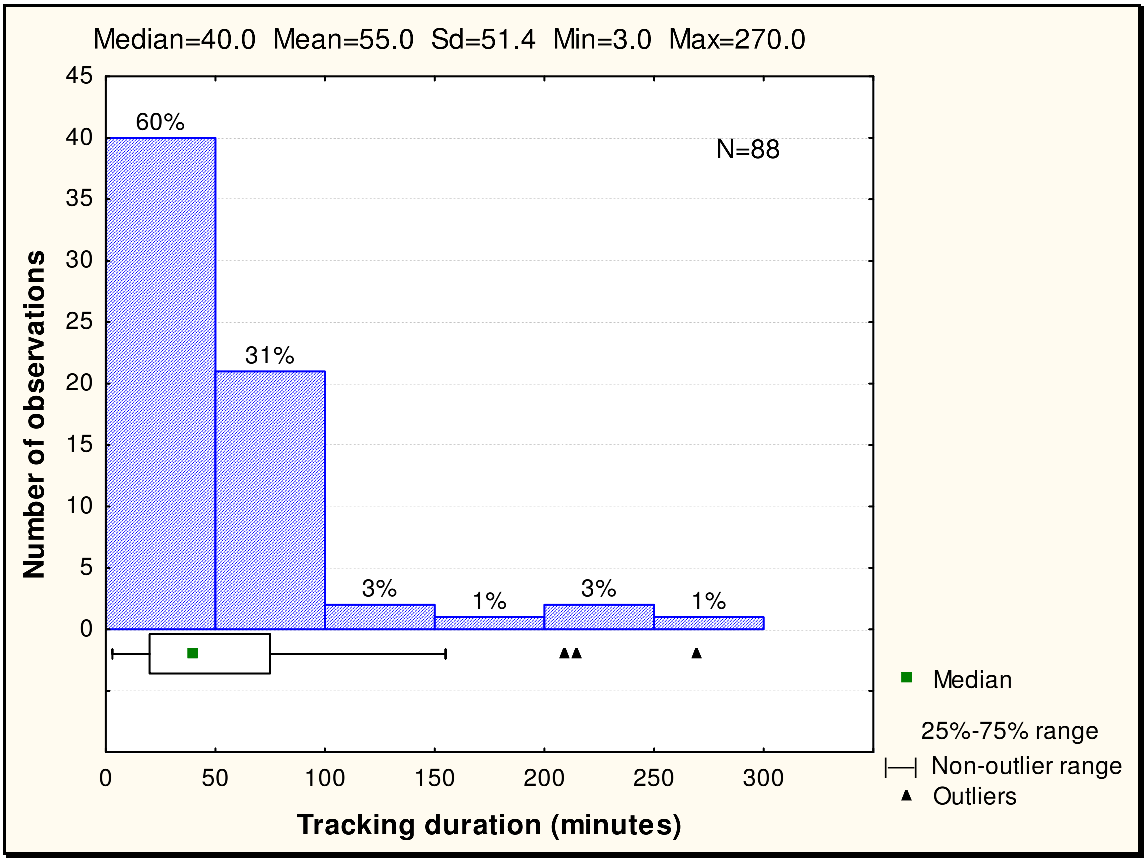
The research was conducted in two conservancies and a concession area. The first is the ≠Khoadi-//Hôas Conservancy. The study area in ≠Khoadi-//Hôas Conservancy was the Klip River valley where two translocated black rhino bulls resided. The second conservancy involved is the Torra Conservancy where two study locations were covered namely the Springbok River area, where four transmitter-fitted animals occurred, and the Poacher's Camp area, with five transmitter-fitted animals. In the Palmwag Concession Area the Barab and Aub Rivers were the study locations. The Barab River location had nine transmitter-fitted animals and the Aub River had four such animals. These two areas were combined as the black rhinos moved freely between them (see Appendix E).

The researcher gathered 7% of the HID forms from the Klip River area. This can be accounted for by the fact that only two black rhino bulls were present in the Klip River area during the research period. Nineteen per cent of HID forms were gathered from each of the Springbok River and Poacher's Camp areas with a combined total of 38% of the HID forms from the Torra Conservancy. The bulk of the HID forms (55%) were completed in the Barab and Aub Rivers, because 13 transmitter-fitted animals resided there and the area is home to the largest concentration of black rhino in the Kunene region.

The number of observers is also part of the pre-viewing data. This is important for determining the potential disturbance to black rhino with increases in the number of observers. The number of observers varied between six and one. The majority of observations consisted of four observers being the researcher and three trackers (44%). The number of observers never exceeded six, being six on only 1% of occasions.

The tracking duration included both spoor tracking and locking of telemetry signal until sighting. Tracking duration varied significantly, with the maximum time being 4.5 hours and the minimum being only three minutes. The mean time of tracking was 55 minutes.

The time from picking up fresh spoor or receiving telemetry signals to the sighting of rhinos are presented in Figure 4.2.



Source: HID forms

Figure 4.2: Time expired from picking up spoor/telemetry signal to black rhino location

Tracking times that exceeded 300 minutes were excised because such long spans are deemed unfeasible for tourism activity. The excessive times recorded were due to the rugged nature of the terrain traversed in search of the rhinos.

4.3.2 Viewing data

The viewing data in the HID forms cover the period from the time the individual black rhino was located until it was displaced (forced to leave) or no longer observed (observers left the observation site). The viewing data include information about the circumstances around the viewing site but exclude the behaviour of the rhinos during observation.

Table 4.1 lists the sighting data for the black rhinos observed in this research. Clearly, most (more than 80%) of the sightings were made while the observers were on foot and more than three quarters of the sightings were the result of tracking.

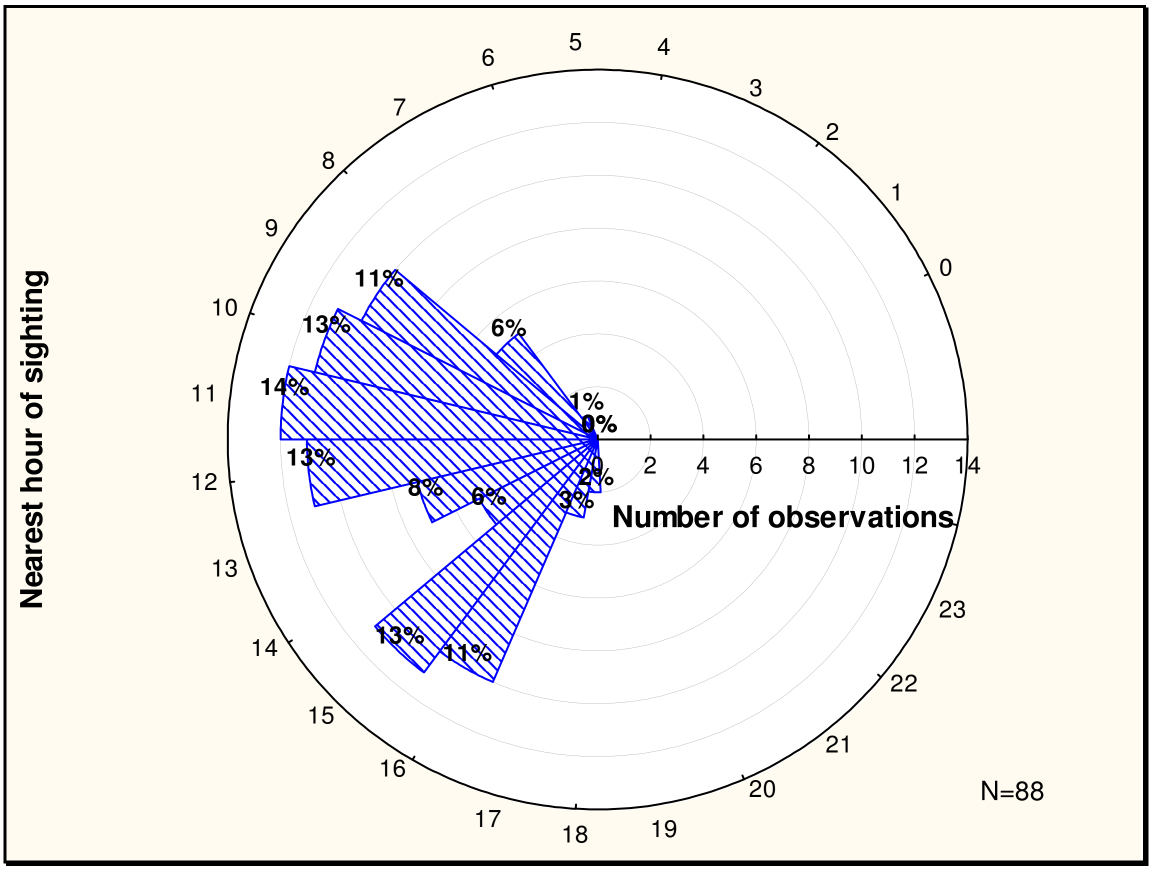
Table 4.1: Black rhino sightings

HID forms completed	**Type of sighting**		**Chance sighting**		**Rhino flushed by vehicle**	
	Foot	Vehicle	Yes	No	Yes	No
%	83	17	23	77	8	92
N	73	15	20	68	7	81

Source: HID forms

The 75% of the black rhinos were located with the help of telemetry equipment. The research team switched off the vehicle as soon as a telemetry signal was received. The team then searched for spoor and proceeded on foot for the duration of the tracking, only using the telemetry when the spoor was lost. This was done to avert disturbance of the animal being tracked and in so doing, increase the chances of acquiring the necessary data. Because most of the tracking was done on foot, less than 10% of the rhinos were flushed by the observer's vehicle.

The majority of spoor sightings or telemetry signals were achieved early in the morning, which was mainly due to characteristic black rhino behaviour and because observers set out at first light. Most of the rhinos were located between 08:00 and 13:00 (57%) and again in the late afternoon between 14:00 and 17:00 (35%) (see Figure 4.3). Joubert & Eloff (1971) describe black rhinos as being crepuscular; that is they are most active at dawn and dusk. Black rhinos sleep during the middle of the day when it is hottest and move mostly between the evening and late-morning.



Source: HID forms

Figure 4.3: Nearest hour of rhino location

The environmental factors that play a role in black rhino behaviour relate to the locations where they were observed. The habitat where rhinos are found play a role in their reactions, so does the presence of other animals and wind direction and natural characteristics of the particular animal.

Most (44%) animals were located in riverbeds and on gentle slopes (28%). The dominant plant species at the sighting locations support the findings of the locality sightings with *Colosphorpermum mopane* being the dominant species on 26% of occasions and *Euphorbia damarana* on 36%. *Colosphorpermum mopane* normally occurs in riverbeds and *Euphorbia damarana* on gentle slopes in the study areas.

Seventy-three per cent of observations were recorded from downwind of the rhino. Black rhinos have an excellent sense of smell so to avoid detection the tracking team attempted to be downwind of the rhino at all times. This was, not always possible given unexpected changes in wind direction, which occurred during 10% of observations. The terrain did not always permit a change in observation direction.

The presence of other animals at the sighting locations was also recorded. Other animals were only present at 17% of the sightings and on the other 83% of sightings the rhinos were alone. The main other species present were greater kudu (*Tragelaphus strepsiceros*), Hartmann's mountain zebra (*Equus zebra hartmannae*), gemsbok (*Oryx gazella*), baboon (*Papio hamadryas ursinus*) and springbok (*Antidorcas marsupialis*). This evidence confirms the black rhino's behavioural preference for occurring in a solitary state.

4.3.3 Black rhino behaviour

Rhino behavioural activity was recorded at the initial observation and again at the final observation. Initial undisturbed behaviour can be explained by black rhinos' general behaviour typical to the time of day (stated in section 4.3.2). Table 4.2 gives an indication of the activities of the observed animals when initially and finally observed.

Table 4.2: Behaviour of black rhinos when initially and finally observed

		Activity				
	Count	**Lying**	**Standing**	**Walking**	**Browsing**	**Running**
Initial behaviour	**%***	31	24	16	23	7
	N	27	21	14	20	6
Final behaviour	**%***	24	23	10	16	27
	N	21	20	9	14	24

*Percentages do not add to 100 due to rounding

Source: HID forms

Initial behaviour of black rhinos was recorded as the "activity" at the first sighting of the animal. On seven per cent of the occasions the rhinos were already running when sighted indicating that the animal was aware of the tracking team before the tracking team became aware of the animal's presence. Although this behaviour was deemed to be a disturbance, the cause of the disturbance is indeterminate. The predominant initial behaviour was lying down, followed by standing, browsing, walking and running. The final behaviour of the rhino was noted when the observation team left the observation site or when the animal was displaced by the observers. Table 4.2 indicates that a large percentage of the observations indicated final behaviour of animals as seriously disturbed and running away. After running away the most noted behaviours were lying down, standing, browsing and walking.

The extent of the disturbance of the rhino was measured by the change in normal behaviour during observation (Table 4.3). It was found that 64% of the rhinos changed their normal behaviour while being observed. Only 23% of the observations showed a return to unaware behaviour. Unaware behaviour was determined by observing whether an animal continued the activity it was conducting at the time of the initial observation or if the animal appeared relaxed despite the presence of the tracking team.

Table 4.3: Change in behaviour during period of observation.

Count	Changed normal behaviour during observation		Returned to unaware behaviour	
	Yes	No	Yes	No
%	64	36	23	77
N	56	31	13	44

Source: HID forms

Causes of displacement of rhinos were documented in three categories, namely observer noise, wind change and other. The other category being any cause of displacement that did not involve the tracking team. Table 4.4 presents the causes of changes in behaviour during the period of observation.

Table 4.4: Causes of change in rhino behaviour during observation

Count	Causes of change in behaviour		
	Observer noise	Wind change	Other
%	75	9	16
N	42	5	9

Source: HID forms

Observer noise was the cause of displacement in 75% of the observations, while wind change (9%) and other (16%) were less frequent causes of displacement. The “other” category involved activities not related to the observation team such as the passing of an aircraft or tourist vehicle. Disturbance by the observers resulted in specific reactions by the animals in question. These are presented in Table 4.5.

Table 4.5: Rhino reactions to observer disturbances

	Reaction			
Count	**Run away**	**Run towards**	**Walk away**	**Walk towards**
%*	61	2	19	19
N	33	1	10	10

*Percentages do not add to 100 due to rounding

Source: HID forms

The most common reaction was to run away while walking toward or away from the observers occurred equally frequently. Interestingly, in only one case did the animal run towards the observers.

Readings of the distance of displacement were noted in order to get an indication of the displacement distances in the different study sites. The displacement distance was measured using a range finder that was provided by SRT. The maximum displacement distance was noted as 400 metres, as this was the limit of the range finder's measuring capabilities. Displacement distances of over 400 metres were not noted due to the inability of measuring such distances. Rhinos that were disturbed but did not move are indicated as below zero (39%). These animals were aware of the presence of the tracking team and seemed distressed, but were not displaced. Displacement ranged from 0 to 400 metres with the mean distance being 136 metres. The disturbance which occurred during sightings could also be explained by the time spent observing the rhino. The longer the time spent observing, the greater the risk of disturbance. Time spent observing rhinos ranged from one minute to 65 minutes. The mean observation time was 30 minutes.

The following section gives the results of statistical testing of HID of black rhinos in the study areas.

4.4 Discussion of HID of black rhinos

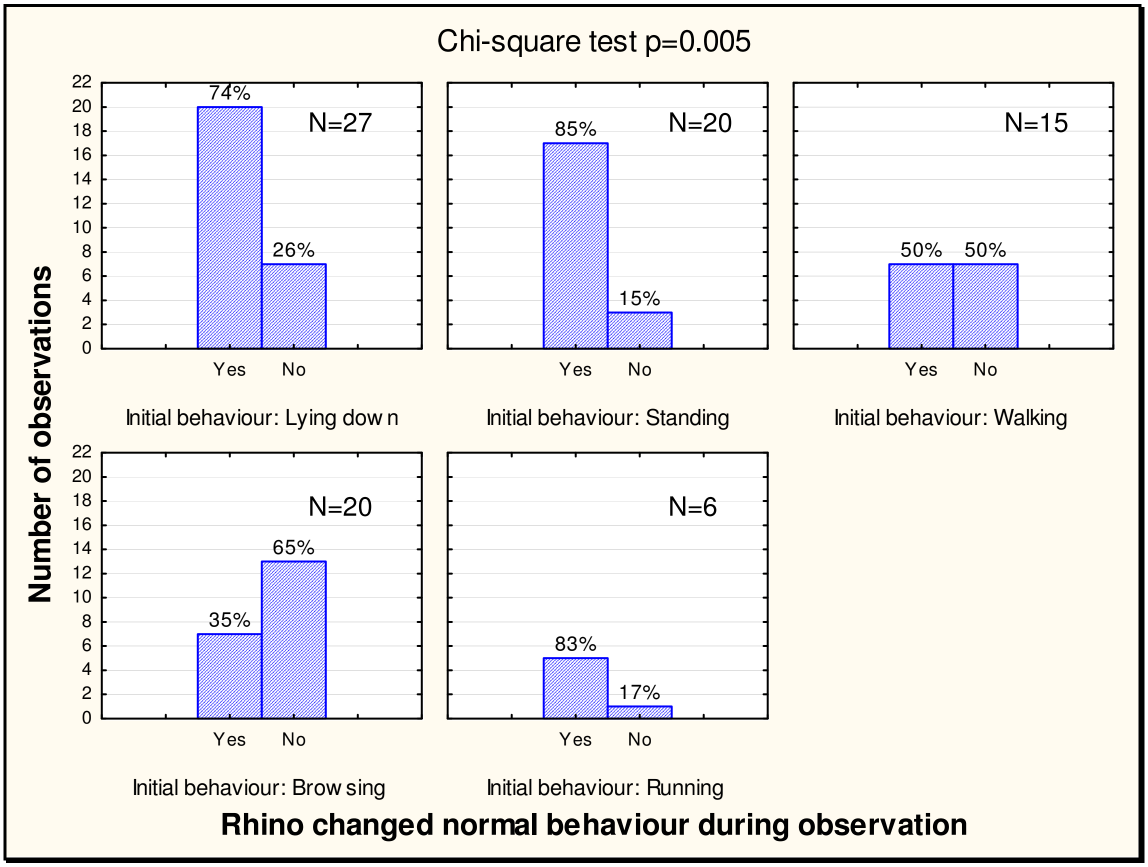
Wild animals may respond to human presence according to recognizable behaviour of avoidance, attraction and habituation. With many animals avoidance of humans starts with alarm behaviour, followed by agitation and then escape to a safer distance (Newsome, Dowling & Moore 2002). In order to better understand the effects of HID on the black rhino, the following five null hypotheses are investigated to determine the acceptability of the first research hypothesis:

- Black rhinos' initial behaviour does not determine a change in behaviour;
- Black rhinos' change in behaviour is influenced by group composition or the presence of other animals;
- Distubance of black rhinos is influenced by observer group size, level of noise and wind direction in relation to observers and time spent observing;
- Behaviour of black rhinos is the same for all the study areas; and
- Black rhinos' ranging behaviour, in terms of size of home ranges, is the same for all the study areas.

The first null hypothesis is investigated by testing whether the initial behaviour of black rhinos influenced a change in behaviour. The following section gives the statistical results.

4.4.1 Initial behaviour vs change in behaviour

The null hypothesis that black rhinos' initial behaviour does not effect change in behaviour was investigated by comparing initial behaviour with the change in behaviour once the rhino were observed. Change in behaviour when comparing initial behaviour to behaviour once the rhino was observed and the trackers were observed by the rhino, was deemed to be a disturbance of the rhino. Figure 4.4 compares the initial behaviour and change in the behaviour once the rhino was observed.



Source: HID forms

Figure 4.4: Initial behaviour vs change in behaviour of black rhinos when observed

A chi-square test was done to determine a reliable fit between initial behaviour and the change in behaviour of the observed black rhino. The results reject the null hypothesis that the black rhino's initial behaviour does not effect a change in behaviour (p=0.005). The expected values differ from the observed values. The black rhino's final behaviour was affected by initial behaviour. Black rhinos that were walking and browsing tended to be less inclined to change behaviour when disturbed. Rhinos that were lying down and standing seemed more alert and were easily disturbed which led to altered behaviour. Running would normally be seen as a change in behaviour, because not all cases of running animals could be attributed to the observation team's presence.

The histograms indicate a clear situation of no change in behaviour with the rhino activity of walking (50%) and browsing (65%). In terms of standing and lying down, however, there is a definite change in behaviour.

These results indicate that initial behaviour does determine a change in behaviour. Black rhinos are more easily disturbed when they are lying down (74%) or standing (85%) and they are less likely to be disturbed when they are walking or browsing. The null hypothesis is therefore, rejected.

4.4.2 Influence of group composition and other animals on behaviour

The null hypothesis that the black rhinos' final behaviour is influenced by group composition or the presence of other animals was investigated by comparing the group compositions of observed rhino with their reactions and distance displaced. Behavioural changes caused by the presence of other animals were also recorded.

Group composition comprised three classes, namely male, female or cow-and-calf. Statistical tests where conducted to determine the degree of disturbance for the various compositions. Rhino reaction per composition was the first variable investigated by the chi-square test for goodness of fit.

The results indicate that there was no statistical difference to generalize from the sample in regards to disturbance and bull composition ($p=0.520$). Groups containing bulls ran away in 65% of the observations, while groups that ran away but contained no bulls occurred 55% of the time. The results indicate that groups composed of males did not differ regarding reaction from groups that did not contain males. Tests of groups that were composed of female animals indicated that there was no statistical difference to generalize from the sample ($p=0.263$). The results show that groups that were composed of females did not differ in their reactions from groups that contain no females. One can conclude that female animals did not react differently to males. The test whether the presence of a calf changed the behaviour of the rhino revealed that the presence of a cow-and-calf was not statistically significant to generalize from the sample (p=0.842). The results indicate that there was no significant change in behaviour in groups containing calves hence the presence of calves did not change the behaviour of the rhino.

The above results indicate that black rhino reaction does not change according to group composition. The degree of disturbance, measured in metres displaced, according to group composition was also examined. ANOVA tests were used to investigate displacement distance for different group compositions. The Mann-Whitney U test was applied to determine the difference between group composition and the distance displaced. Table 4.6 presents the results of the statistical analysis of group composition and distance displaced.

Table 4.6: Mean distances displaced (metres) of group compositions

Composition		N	Mean	Sd
Male	No	31	163.6	163.2
	Yes	57	121.4	186.2
Female	No	69	132.4	169.3
	Yes	19	150.5	182.6
Cow+Calf	No	64	138.5	169.3
	Yes	24	130.5	181.9

Source: HID forms

The mean distance displaced for groups of male composition and those without males differed. Male composition groups were displaced by a mean distance of about 121 metres whereas groups that contained no males were displaced by a mean distance of about 164 metres. There was however, no statistical difference between the means of distance displaced and male composition (Mann-Whitney U p=0.580). The female groups displaced over a mean distance of 151 metres and groups with no females were displaced a mean distance of 132 metres. No statistical difference exists between the means of groups with females and without females, concerning distances displaced (Mann-Whitney U p=0.830). Groups with cow-and-calf composition were displaced a mean distance of 131 metres and for those without cow-and-calf the mean distance was 139 metres. The result was not statistically significant (Mann-Whitney U p=0.61).

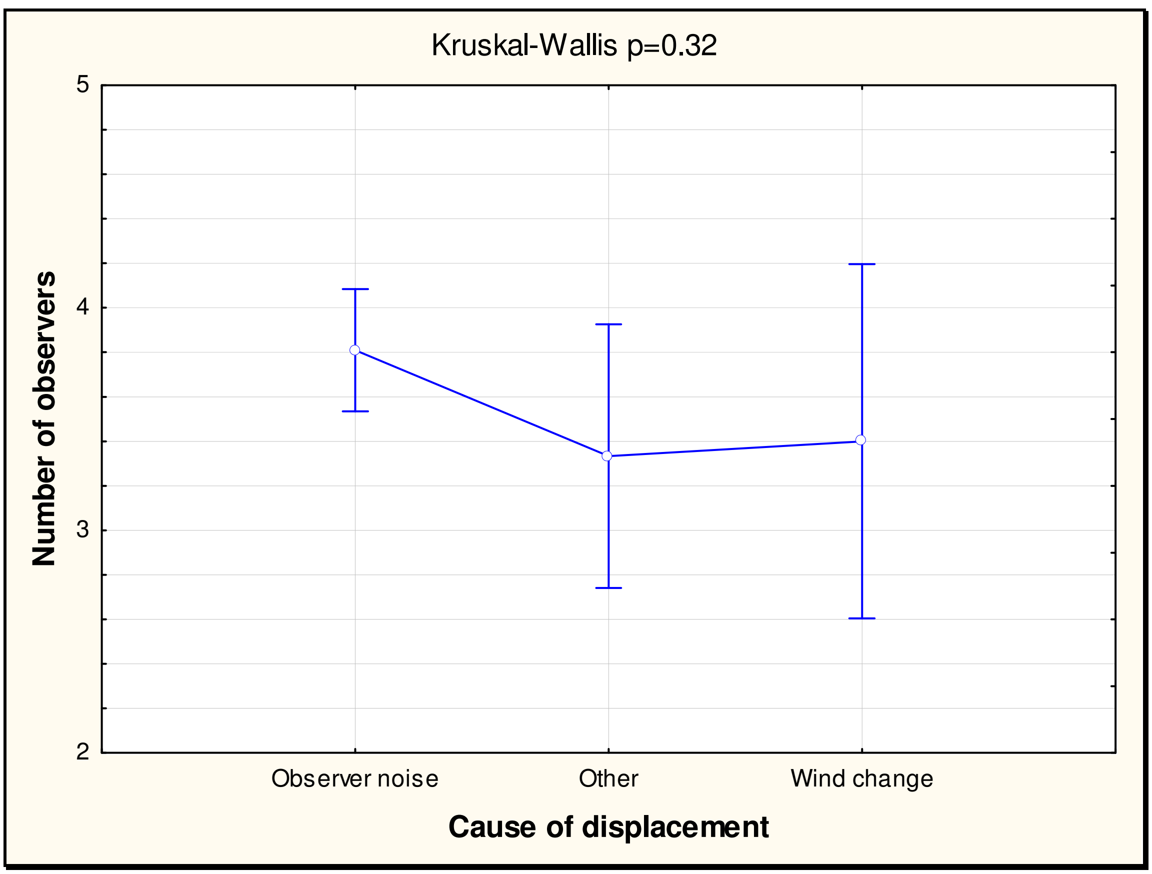
The chi-squire test was used to determine the goodness of fit in situations where other animals were present. The effect of the presence of other animals on rhino behaviour was tested to determine whether a disturbance of the other animals caused any disturbance among the rhino. It emerged that the presence of other animals did not effect any change in black rhino behaviour. The tests indicate that there was no statistical difference (p=0.699). The presence of other animals was also assessed regarding the rhinos changing their behaviour or returning to unaware behaviour. Statistical testing indicated that the presence of other animals did not alter rhino behaviour in the form of their returning to unaware behavior after being disturbed (p=0.428). Black rhinos are solitary animals and tend to be found alone or rarely in the presence of other animals. It appears that black rhinos are not disturbed by other animals and other animals do not affect them in returning to unaware behaviour. Disturbance of other animal species in the vicinity of a black rhino does not disturb the rhino.

On the grounds of the above results, the null hypothesis concerning group composition and the presence of other animals was rejected. The following section will probe human influences on black rhino behaviour.

4.4.3 Human factors effecting change in black rhino behaviour

The null hypothesis that black rhinos' final behaviour is influenced by observer group size, level of noise and wind direction in relation to observers was investigated by comparing observer group size and time spent observing, as a probable cause of displacement.

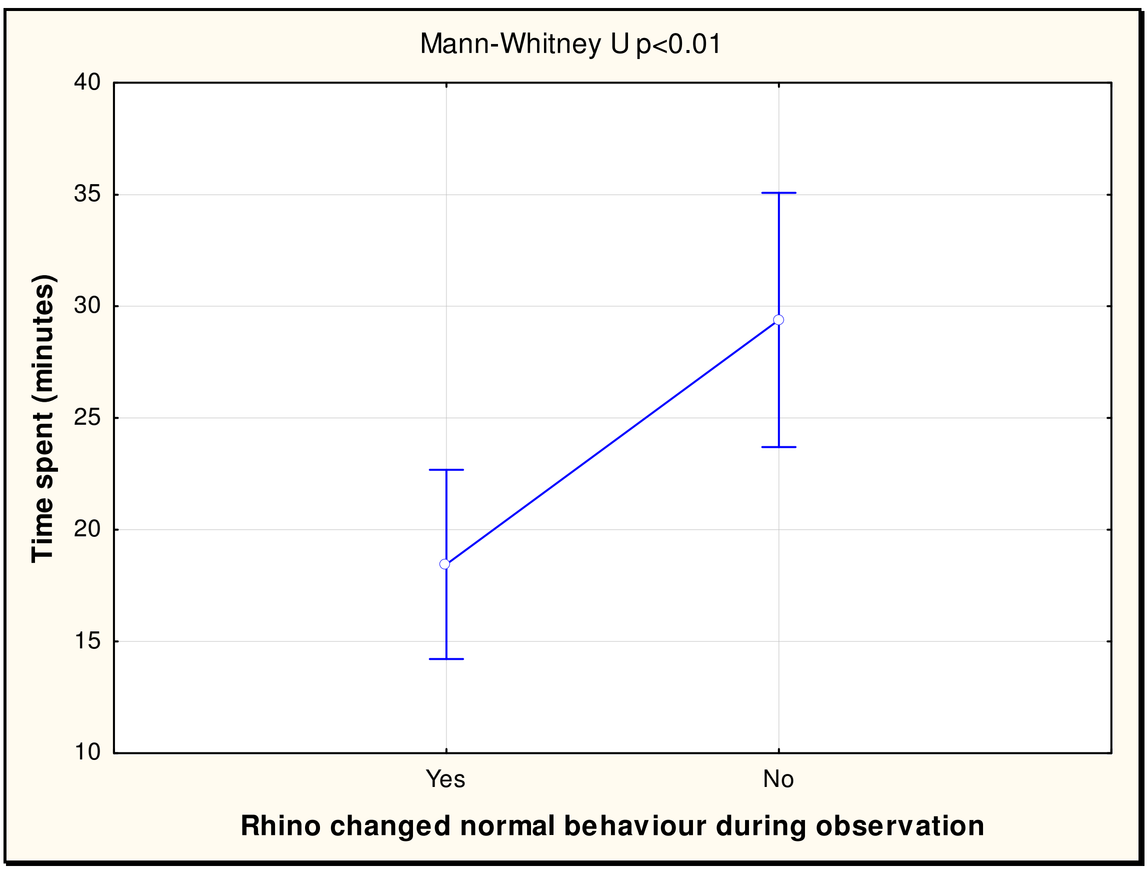
Observer group size was tested in relation to a change in the normal behaviour of the rhino. On 64% of observations there was a change in the normal behaviour of rhino. The test results show that increases in group size tended to cause a change in behaviour with no statistically significant difference (Mann-Whitney U p=0.7). This is quite likely due to group sizes being small during most of the observation episodes. The lack of variation associated with group size was further investigated by considering the cause of displacement of animals during observation periods. Number of observers present was tested against the cause of displacement of animals. Three out of four (75%) of rhinos being displaced were caused by observer noise. Figure 4.5 shows that an increase in observer numbers tended to produce more cases of displacement of rhinos through observer noise.



Source: HID forms

Figure 4.5: Cause of displacement in relation to the number of observers

The Kruskal-Wallis test was used to determine the statistical difference between the number of observers and the causes of displacement. Although Figure 4.5 suggests that observer noise contributed to more instances of displacement of rhino as observer numbers increase, there is no statistically significant difference between causes of displacement and observer numbers (Kruskal-Wallis $p=0.32$). This is probably due to the lack in variation of observer numbers at sightings and the fact that only 25% of cases of displacement occurred due to wind change and other factors not involving the observer group. Whether the time spent at observation sites caused disturbance to the rhino was also analysed by comparing time spent with any changes in normal behaviour of the rhino (see Figure 4.6).



Source: HID forms

Figure 4.6: Incidence of an influence of time spent at observation site on rhino normal behaviour

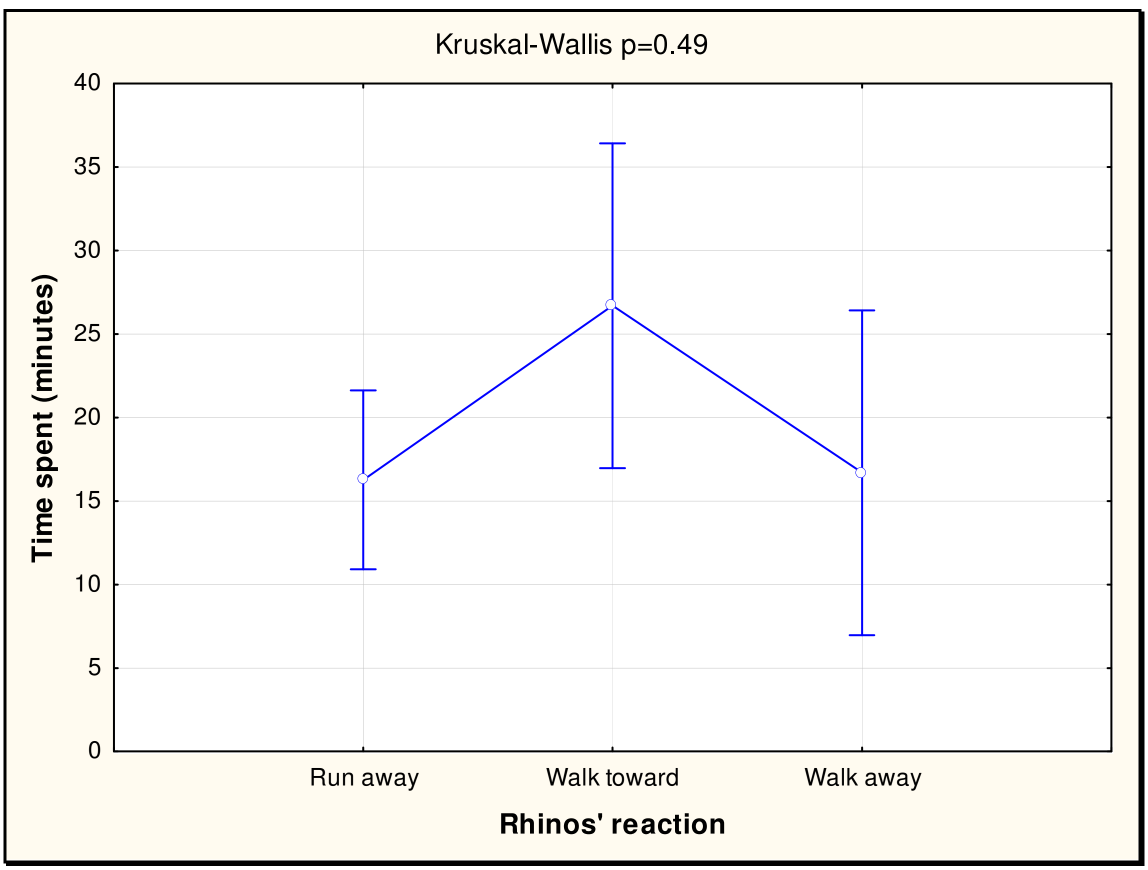
The Mann-Whitney U test indicated a statistical difference in time spent at an observation and a change in the normal behaviour of rhino (Mann-Whitney U $p<0.01$). According to Figure 4.6 there is a statistical difference between time spent at an observation site and on the normal behaviour of the rhino. A change in normal behaviour occurred early in the observation occasion and the chance of causing a change in behaviour decreased as time passed during the observation period. This finding suggests that animals that were not disturbed early in an observation event tended to be less likely to be disturbed later in the same observation event. This raises the question whether animals that were disturbed early in the observation event would return to normal behaviour later. Figure 4.7 indicates that a statistically significant difference exists.

Source: HID forms

Figure 4.7: Disturbed rhino return to unaware behaviour as observation time increased

It appears that animals that were disturbed early in observation events did not return to unaware behaviour, while animals disturbed later on did return to unaware behaviour (Mann-Whitney U p=0.07). The result strongly suggests that the most critical time when observing black rhinos is early in the event. Therefore, approaching black rhino to observe them should be done with caution regarding level of noise made by observers and wind direction.

Another change in behaviour that was tested is the reaction of disturbed animals to the presence of observers. The Kruskal-Wallis test was used to determine which action resulted during an observation event as time passed. Figure 4.8 shows that the reactions of the rhinos were to run away, walk away or walk towards the observers.



Source: HID forms

Figure 4.8: Reactions of rhinos in relation to observers' time spent at observation site

The test results indicate that there is no statistically significant difference in the actions of observed animals as observation time passed (Kruskal-Wallis p=0.49). Statistically, there is no significant change in actions, but Figure 4.8 indicates that the reaction of walking toward the observers results from prolonged observation periods. *Post hoc* test of the means was applied to determine if the action of walking toward observers fits with walking away and running away (see Table 4.7). The Bonferroni test was used to determine the significant differences between means.

Table 4.7: Bonfferoni test of the means with time as variable

		Means	
	Run away	**Walk toward**	**Walk away**
Rhino Reaction	**16.3**	**26.7**	**16.7**
Run away		0.2	1.0
Walk toward	0.2		0.5
Walk away	1.0	0.5	

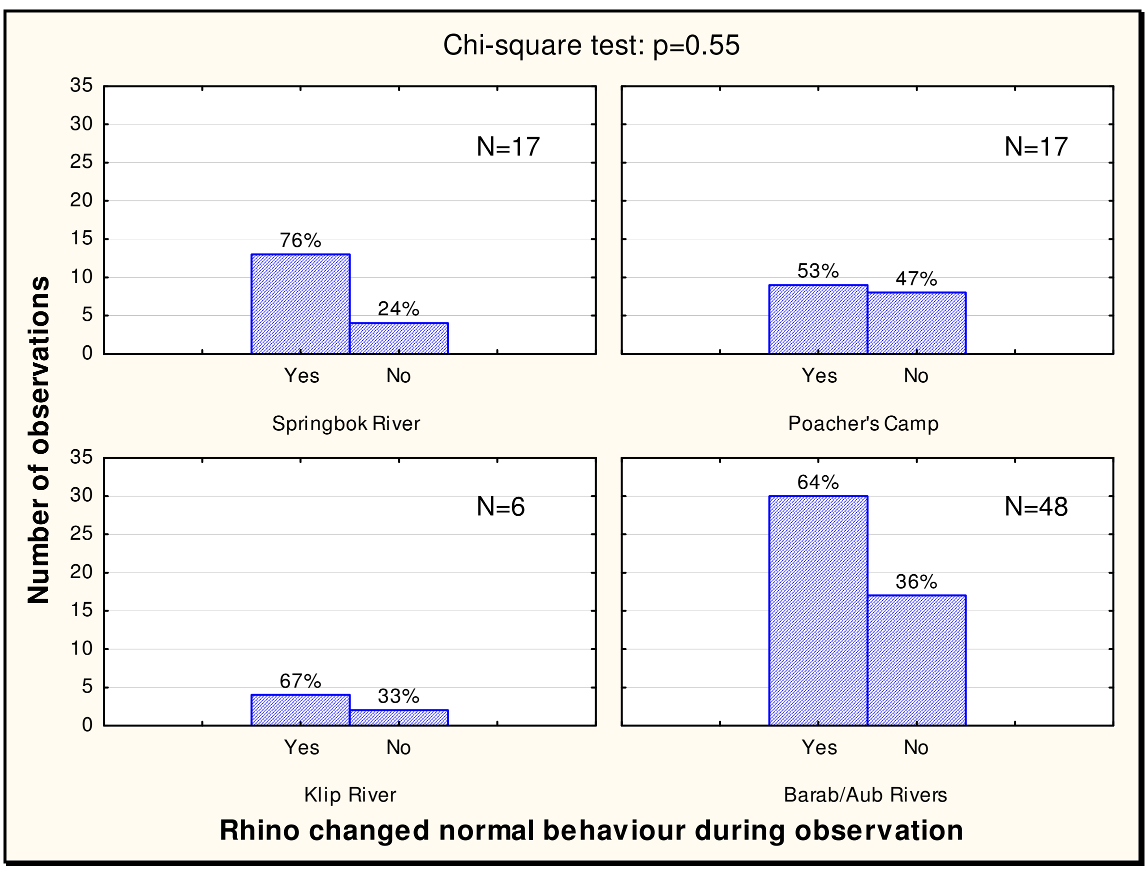
Source: HID forms

The Bonferroni test of significant pairwise comparisons of means indicates that the rhino actions of walking away and running away are correlated. Table 4.7 shows that the means of running away and walking away are similar and thus have a value of 1.0. The action of walking toward observers does not correlate with the other two actions. Disturbed animals ran away and walked away from observers early in observation sessions and walked toward observers when disturbed later in observation events. The action of walking toward observers as observation time increases may be related to the curiosity of the observed animal.

The null hypothesis that black rhino disturbance is influenced by observer group size, level of noise, wind direction in relation to observers and time spent must be rejected on the grounds of insufficient statistical evidence.

4.4.4 Difference in black rhino behaviour among study sites

The four study sites were located in different management zones. These zones represent two communal conservancies and a concession. The concession is leased to Wilderness Safari's by the Namibian government and is where the Aub/Barab Rivers are located. The Klip River is situated in the #Khoadi-//Hoas Conservancy and the Klip River valley is the conservancy's wildlife zone for non-hunting tourism. The Poacher's Camp and Springbok River areas are both situated in the Torra Conservancy and in both areas hunting occurs for consumptive and trophy-hunting purposes. Data for the four study sites were compared to uncover any differences in behaviour of sub-populations subjected to different management styles. Figure 4.9 illustrates whether changes in behaviour of rhino during observation took place in the study sites.

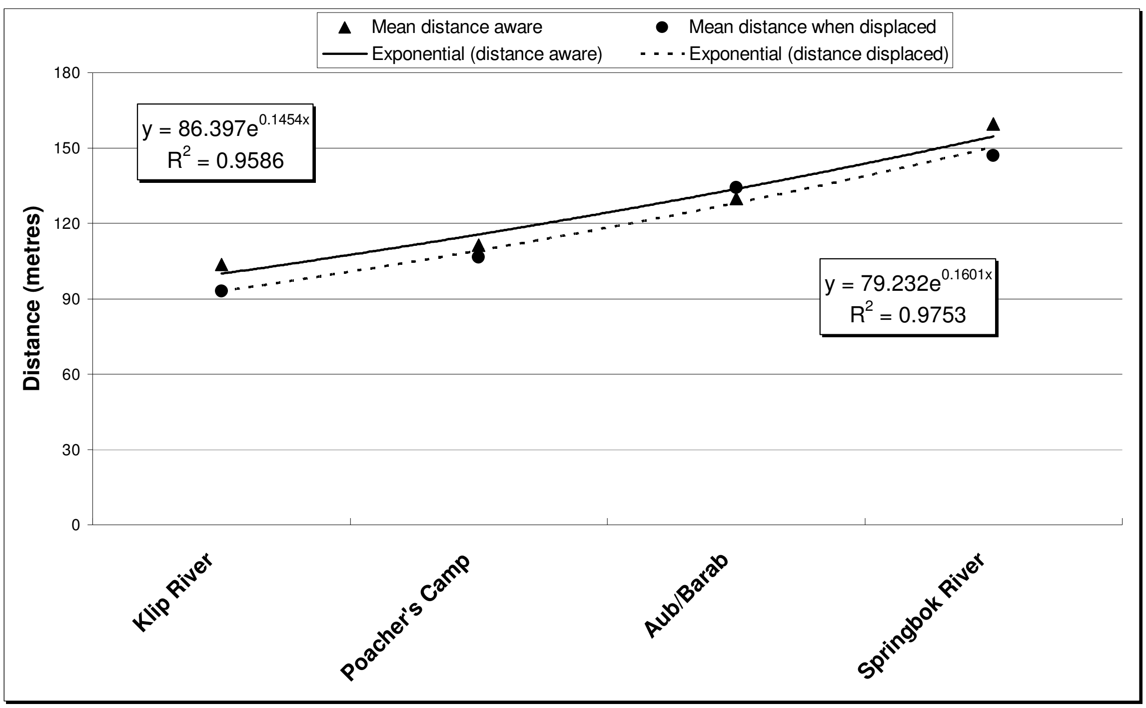


Source: HID forms

Figure 4.9: Change in normal black rhino behaviour during observation in study sites

A chi-square test was used to determine the goodness of fit between the study sites and changes in rhino behaviour. No statistically significant difference between the study sites and a change in rhino behaviour was found (p=0.55). Klip River was not considered to be a reliable reflection of rhino behaviour as only two rhinos were observed there.

A regression analysis was undertaken of the mean distance from observers at which rhino became aware of observers and the mean distance from observers at which rhino were displaced. Figure 4.10 presents the results.



Source: HID forms

Figure 4.10: Mean distances of rhino awareness of observers and when displaced in study sites

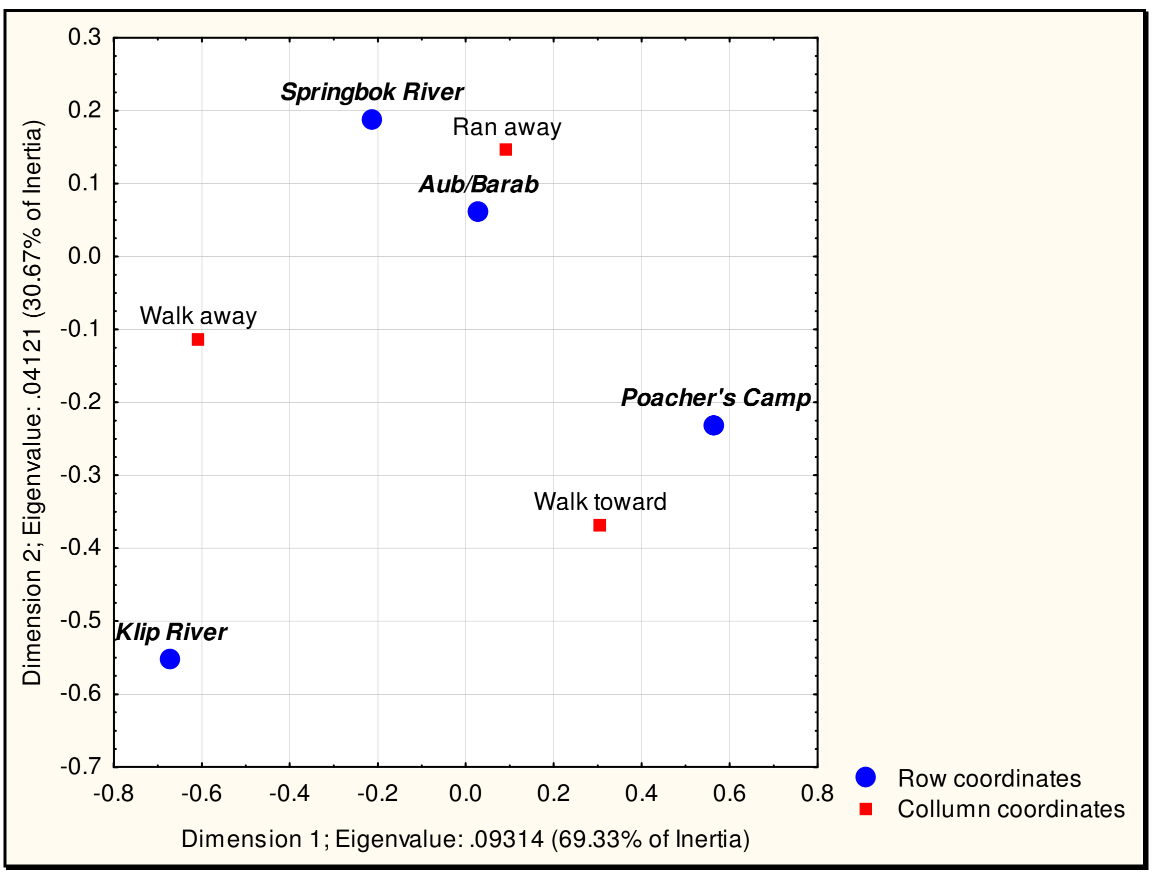
The equations for the exponential trendlines are:

Mean distance when rhino became aware: $Y = 86.397e^{0.1454x}$ $(R2 = 0.9586)$

Mean distance when displacement occurred: $Y = 79.232e^{0.1601x}$ $(R2 = 0.9753)$

The exponential trendlines indicate that there was a 14% rate of increase in the distance when rhino became aware of observers from the Klip River to the Springbok River. Similarly, the distance of displacement increased at a rate of 16% between the study sites. The results suggest evidence that the Springbok River animals became aware of observers at the greatest distance from observers and they were also displaced further away from observers.

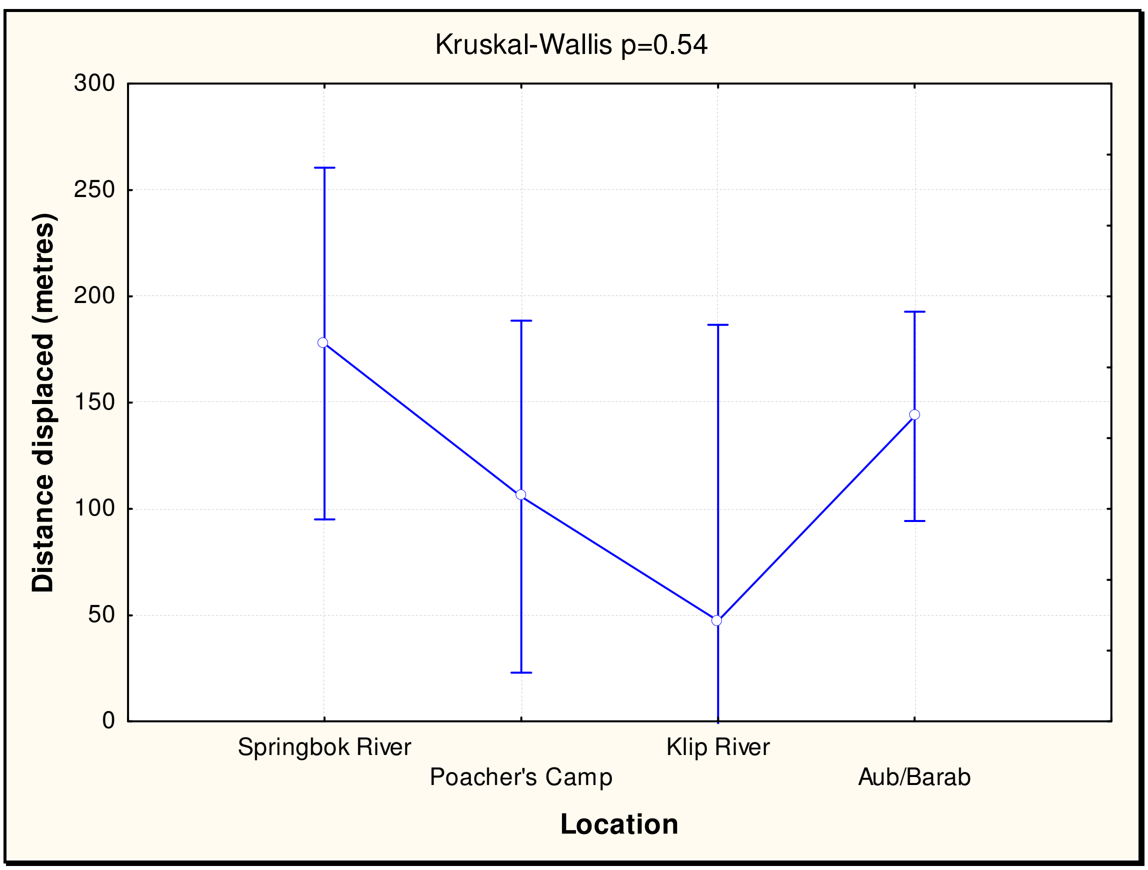
Further investigation was made of the reactions of the rhino after disturbance occurred by applying a chi-square test. The test indicated that there is no statistically significant difference in rhino reaction between the study sites (p=0.232). The data are further explored by correspondence analysis designed to analyse a two-way table containing some measure of correspondence between the rows and columns (Figure 4.11).



Source: HID forms

Figure 4.11: Black rhino reaction to disturbance in study sites

The percentage of inertia is the chi-square for the two-way table in Figure 4.11 divided by the total sum of factors. The Eigenvalues are the proportion of variance accounted for by the correlation between the respective locations and rhino reactions. The Springbok River and Aub/Barab River black rhinos are readily disturbed, because their reaction to disturbance was to run away. The Poacher's Camp animals have a more curious reaction (they walk toward observers) to disturbance than the rest of the cases, which could be an indication of habituation. As mentioned earlier, the Klip River results are not significant as only two animals were observed and they did not show a distinct reaction to disturbance. The Kruskal-Wallis test was used to determine the statistical significance of how far rhino were displaced according to study site. The analysis for the Klip River is unreliable as the sample size was small. The results of the Kruskal-Wallis statistical test are shown graphically in Figure 4.12.



Source: HID forms

Figure 4.12: Distances rhinos were displaced per study sites

The results are not statistically significant (Kruskal-Wallis p=0.54). This is mainly due to the small sample size of the Klip River. The graph indicates that Springbok River animals experienced significantly greater mean displaced distances than those at Poacher's Camp. Table 4.8 gives the descriptive statistics for displacement distance per study site.

Table 4.8: Descriptive statistics for distance displaced (metres) per study site

	Distance displaced		
Location	**N**	**Mean**	**Sd**
Total	88	136.3	171.8
Springbok River	17	177.8	189.1
Poacher's Camp	17	105.8	165.2
Klip River	6	47.3	84.9
Aub/Barab	48	143.5	174.4

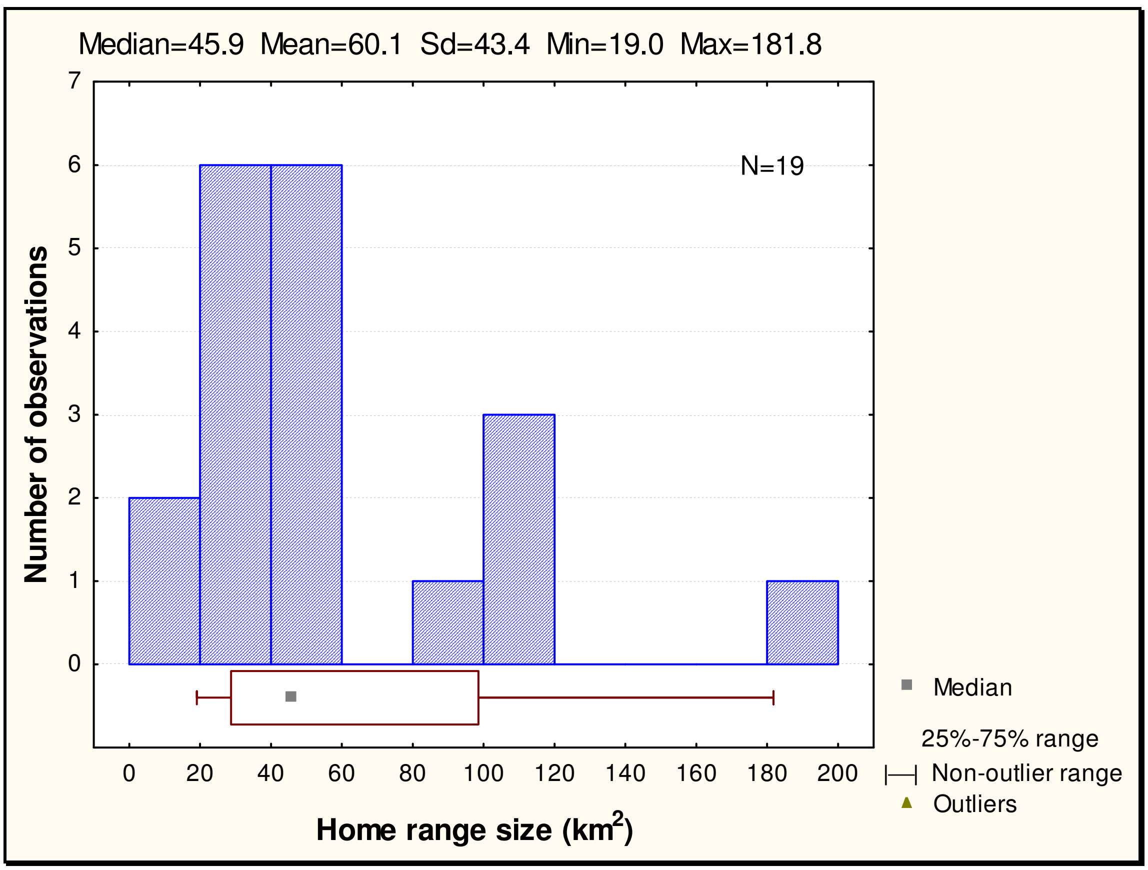
Source: HID forms

The above results indicate that the Poacher's Camp animals, discounting the two animals from Klip River, were displaced the least distance (mean=106) and the Springbok River animals the greatest distance (mean=178). These results complement the results indicated by Figure 4.11 that rhinos from Springbok River and the Aub/Barab tended to run away more often than rhinos from Poacher's Camp.

None of the tests for rhino reactions in the various study sites are statistically significant. This was deemed inconclusive so that the measured differences in severity of reactions per study site were used instead. The reactions of rhinos at the study sites regarding change in behaviour, distance of awareness, reaction to a change in behaviour, distance when displacement occurred and distance displaced, all indicate that the Springbok River and Aub/Barab populations experienced the most severe reactions to disturbance. This was measured in terms of the number of animals displaced by running away and the distance they were displaced. Poacher's Camp animals showed the least severe reactions and the Klip River results were deemed to be insignificant due to the small number of animals observed.

4.4.5 Black rhino ranging behaviour

The size of home ranges of rhinos in the study sites and the home range differences in the various study sites were investigated. Also, possible reasons for the differences in home range were sought. Home ranges were determined using the minimum convex polygons (MCP) method in cases where ten or more fixes for a specific animal were involved. Due to the difficulty of locating animals, only 19 animals had a sufficient number of fixes to determine their home ranges (see Appendix E). Figure 4.13 presents the descriptive statistics for the home ranges of the 19 animals that were studied.

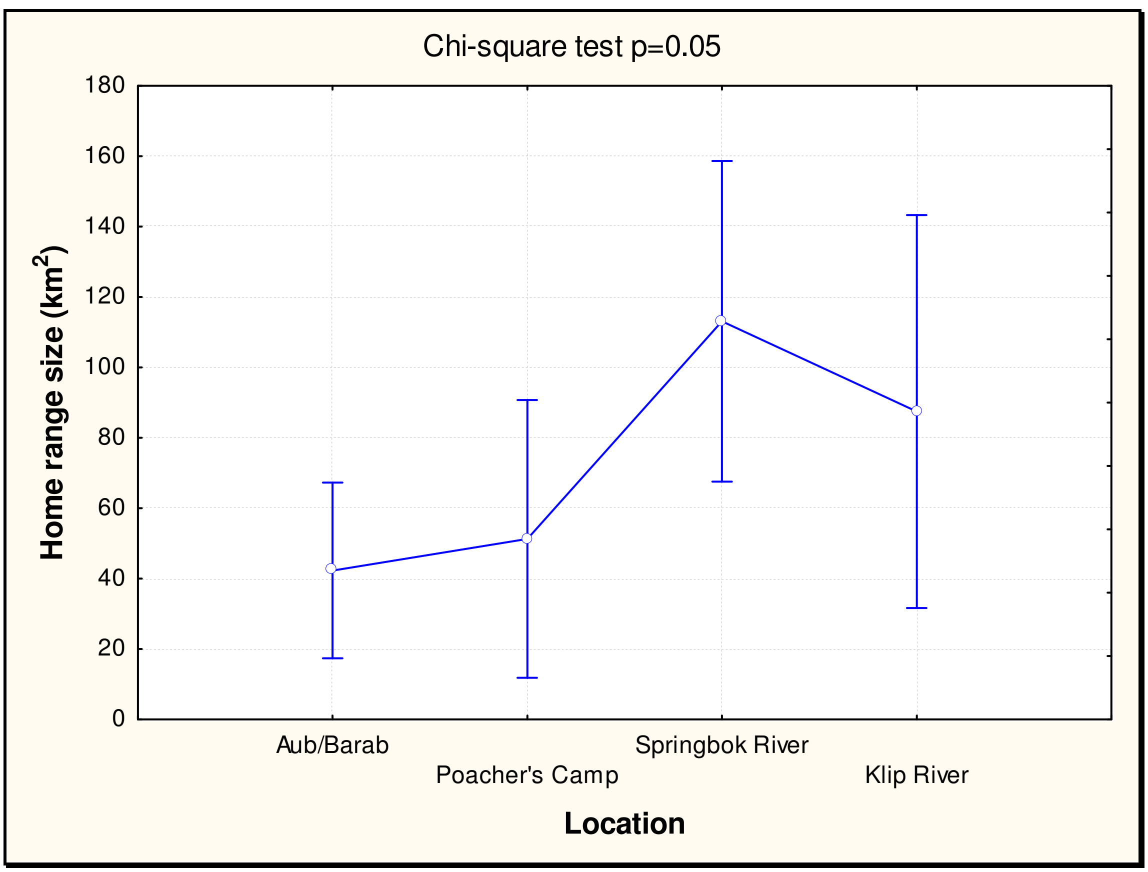


Source: HID forms

Figure 4.13: Home range sizes for rhino

The size of home ranges of all the animals varied between 19 and 182 km² with a mean size of 60 km². The mean home range size for this study differs significantly from that of Hearn (2003) which was estimated at a mean of 162 km² for the Damaraland population (see Appendix F). The results from the present study, however, only involved the high-concentration areas of the Damaraland population. A study of the literature confirms the mean home range size of this study as appreciably greater than those of other locations in Africa (see Appendix F). A likely explanation for this is the harsh conditions in which this study's animals reside.

The sizes of the home ranges of the studied animals were examined according to the various sites and the results show that the Springbok River animals have the largest home range (see Figure 4.14).



Source: HID forms

Figure 4.14: Home range sizes of the four study sites

The results of a chi-square test indicate that there is a statistically significant difference between the home range sizes of the four study sites (Chi-square test p=0.05). The Springbok River animals have the largest home range followed by the Klip River area. The Poacher's Camp and Aub/Barab animals had similarly sized home ranges.

In Figure 4.15 home ranges of male rhinos are presented with green polygons and those of female rhinos by yellow polygons. The polygons indicate that the populations are separated by certain natural-and human-induced boundaries. The most significant factor seems to be the presence of human settlements as indicated by the orange buffers. Black rhinos in the study area seemed to avoid human settlements by a five-kilometres radius as drawn in Figure 4.15. A probable reason for this avoidance is the disturbance caused by livestock that wander around homesteads in communal areas. Morgan-Davies (1996) found that black rhinos in the Masai Mara were normally shy of cattle and have had to abandon about 50 km^2 of two of their prime habitats. The veterinary fence that spans the study area does not seem to deter the movement of the studied rhinos. The Poacher's Camp rhinos are located on both sides of the fence. This could be explained by a number of breaks in the fence caused by elephants (*Loxodonta africana*).

Figure 4.15 clearly indicates that the rhino population is grouped into clusters. The Palmwag Concession rhinos are grouped into two clusters, the Torra Conservancy rhinos into two and the Klip River rhinos into one. The Klip River rhinos were excluded from the analysis because only two newly introduced male black rhinos were present. Such black rhinos take a couple of months to establish fixed ranging patterns. Linklater & Swaisgood (2008) found that the initial settlement was complete within 25 days but that certain components of the permanent settlement process were still incomplete after 100 days.

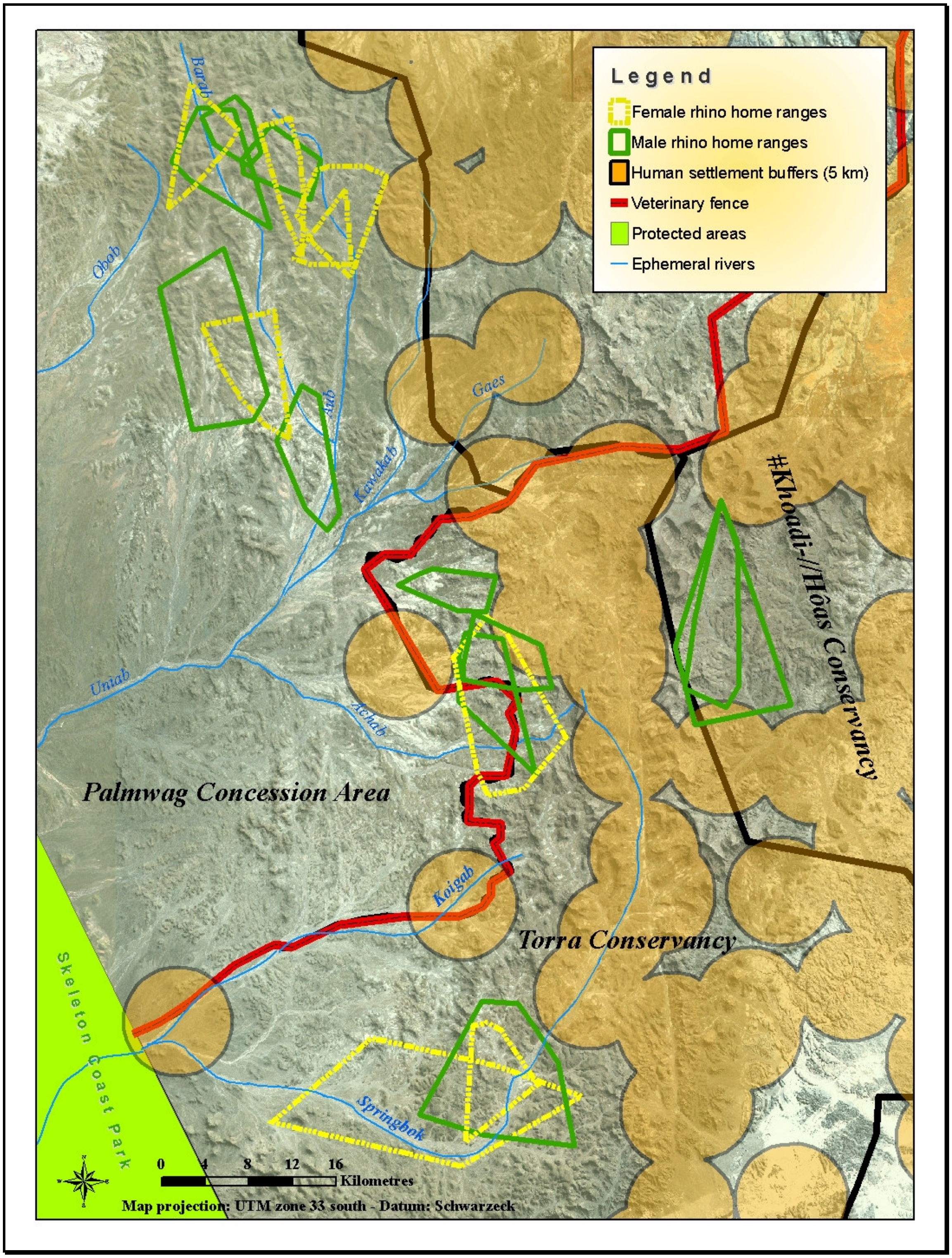
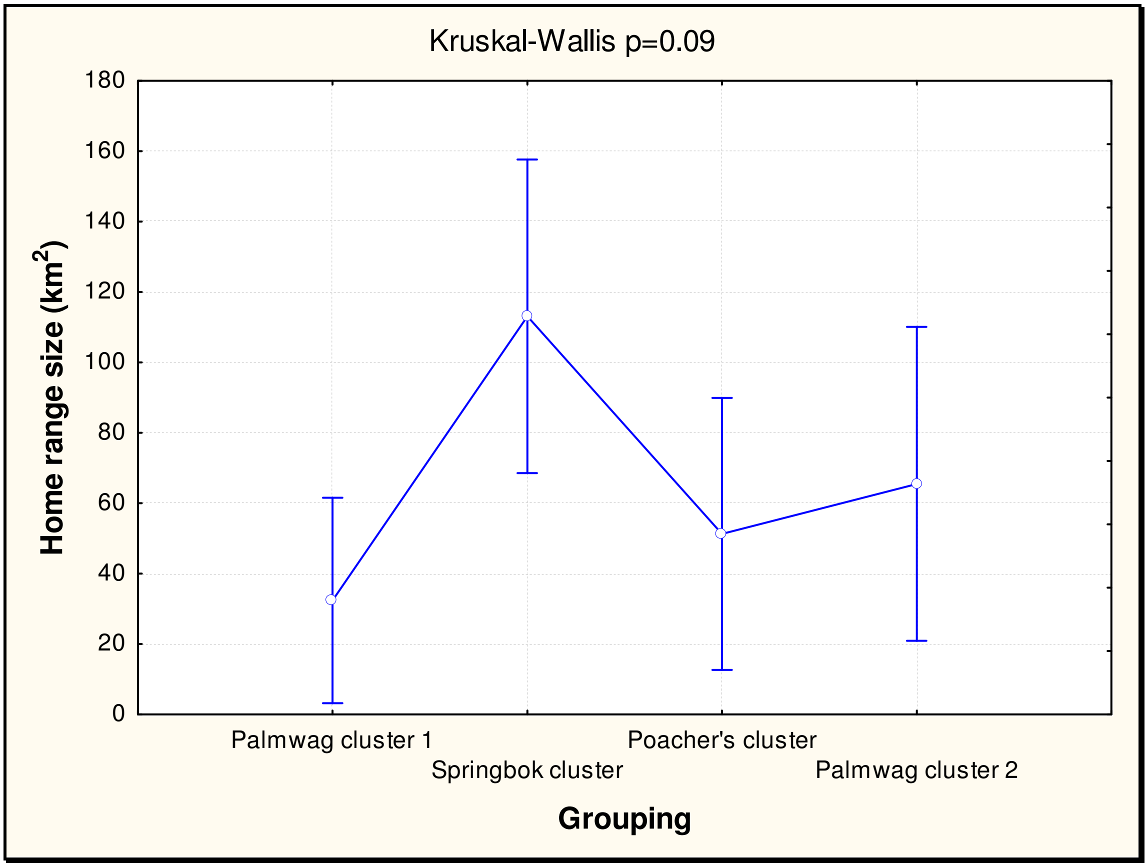


Figure 4.15: Home ranges of 19 studied black rhinos

The clusters were analysed by comparing mean home range sizes to find possible explanations for the groupings of rhino home ranges (see Figure 4.16).



Source: HID forms

Figure 4.16: Black rhino home range clusters

The Kruskal-Wallis test indicates a significant statistical difference between the clusters (Kruskal-Wallis p=0.09). The Palmwag cluster 1 (mean=32.4) and Poacher's Camp cluster (mean=51.2) had smaller home ranges and the Springbok River cluster (mean=113.1) and Palmwag cluster 2 (mean=65.5) had larger home ranges. The Bonferroni test of significant pairwise comparisons of the means was used to examine the differences further (see Table 4.9).

Table 4.9: Bonferroni test of pairwise comparisons of means indicated by Figure 4.16

Area	Means			
	Palmwag 1	**Springbok**	**Poacher's**	**Palmwag 2**
	32.4	**113.1**	**51.2**	**65.5**
Palmwag 1		0.04	1.00	1.00
Springbok	0.04		0.25	0.76
Poacher's	1.00	0.25		1.00
Palmwag 2	1.00	0.76	1.00	

Source: HID forms

Table 4.9 indicates that there is strong correlation between the Poacher's Camp cluster, the Palmwag cluster 1 and Palmwag cluster 2. These three clusters share a value of 1. The Springbok River cluster has a weak correlation to the Palmwag cluster 2 with a value close to 1 of 0.76. The groupings of the clusters can be explained by a combination of human and environmental factors.

All the clusters are forced into the marginal rhino habitat in the west of the rhino range by human settlements with the exception of the Poacher's Camp cluster that is trapped by human settlement on both sides and partly by the veterinary fence to the west (see Figure 4.17). The western part of the rhino range is a marginal area due to the limited amount of annual rainfall that this area receives. Rainfall in Namibia is highest in the north-east and declines across the country to desert conditions in the south and west. The national black rhinoceros management plan of 2009 proposes long-term mean annual rainfall to be the key determinant of rhino carrying capacity and population performance in any given locality. Carrying capacity will be modified by local factors such as soil fertility, topography, availability and quality of surface water and the diversity of plant species suitable for browsers, but for the purpose of this study only mean annual rainfall was considered. Figure 4.17 shows the decline of annual rainfall to the west, where there is a annual rainfall figure of below 50 mm. The home range sizes of rhinos increase to the west as resources become sparse which is an indication of lower ecological carrying capacity (ECC).

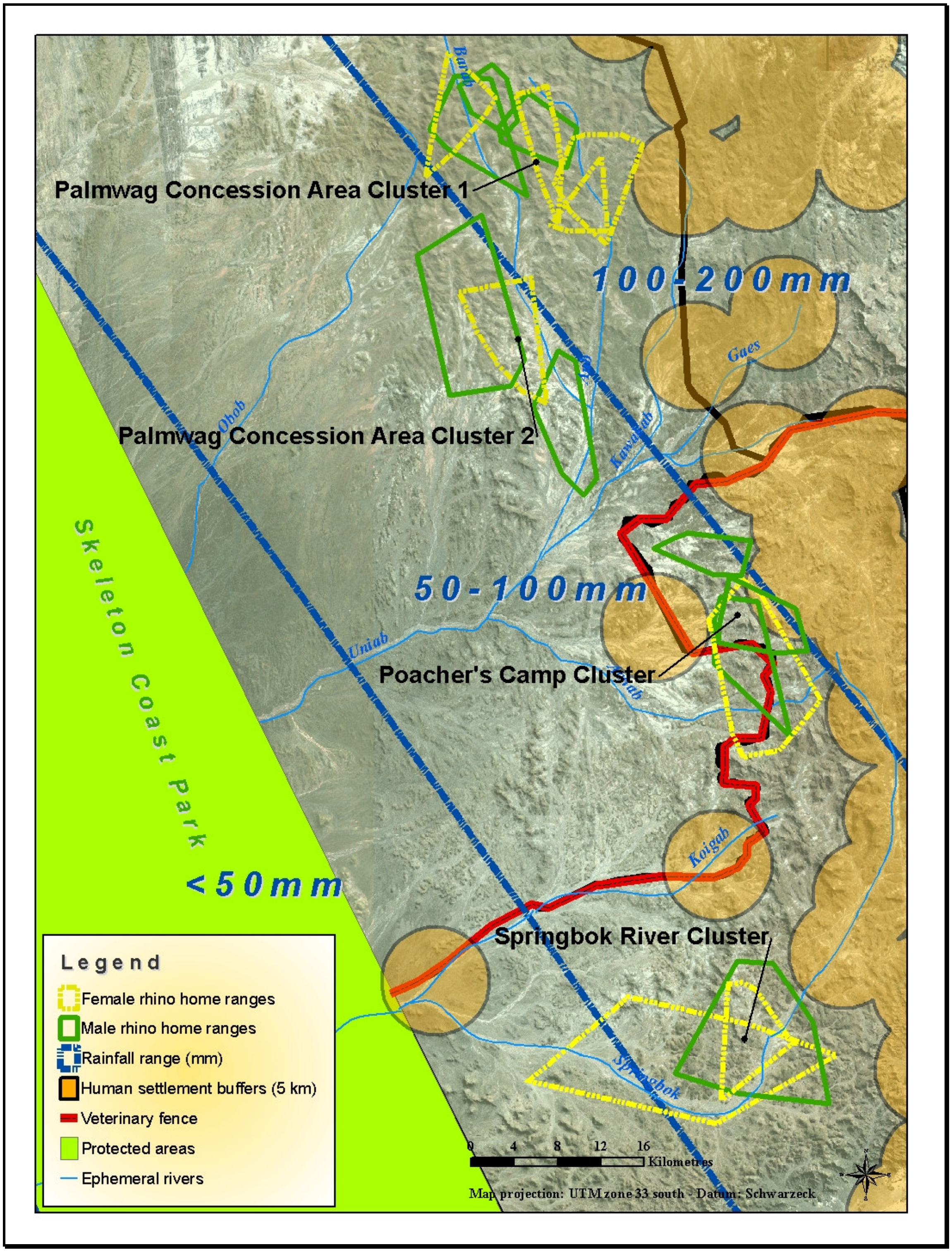


Figure 4.17: Black rhino home ranges grouped into clusters in the three rainfall regions

The ecological carrying capacity for black rhinos of the areas occupied by the clusters was estimated by using mean annual rainfall as the determining factor. Ecological carrying capacity for rhino in the Kunene region has been estimated at 0.01 rhino per km² (Hearn 2003). The ECC of western Etosha National Park is 0.06 rhino per km² and 0.09 rhino per km² for eastern Etosha National Park (Namibia 2010). It was, however, difficult to compare the ECC with mean annual rainfall because of the difference in range between the two data sets. This problem was solved by converting the data to their natural logarithmic values in Excel. These values were used to calculate trend lines for both rainfall and ECC as illustrated in Appendix G.

The natural logarithmic values for the identified clusters of the rhino density on the trend line of the graph were determined by using the (EXP) function in Excel. The results are presented in Table 4.10.

Table 4.10: Estimated rhino ecological carrying capacity for clusters

Area	Rhino density/km²	Mean annual rainfall (mm)
Springbok River	**0.001**	25
Poacher's/Palmwag cl 2	**0.006**	75
Palmwag cl 1	**0.019**	150
Western Etosha National Park	0.060	350
Eastern Etosha National Park	0.090	450
	Natural logarithmic values	
Springbok River	-6.818	3.219
Poacher's/Palmwag cl 2	-5.062	4.317
Palmwag cl 1	-3.954	5.011
Western Etosha National Park	-2.813	5.858
Eastern Etosha National Park	-2.408	6.109

Source: Appendix G

The graph in Appendix G gives estimated EEC for the respective clusters. Table 4.10 indicates that Springbok River has the lowest ECC of 0.001 rhino per km² followed by

Poacher's Camp and Palmwag cluster 2 at 0.006 rhino per km² and Palmwag cluster 1 having the highest at 0.019 rhino per km². There is a positive correlation between ECC and mean annual rainfall. An increase in mean annual rainfall results in an increase in ECC (Appendix G). In terms of home range size, the Poacher's Camp cluster was grouped with Palmwag cluster 1 and 2. The Springbok River cluster is most closely grouped with the Palmwag cluster 2. The groupings could be a result of a combination of human-induced (*i.e.* human encroachment, veterinary fence) and environmental circumstances (*i.e.* marginal areas) that force these animals into larger or smaller home ranges.

The null hypothesis that black rhinos' spatial behaviour regarding home ranges is the same for all the study sites was rejected. There was a definite difference in home ranges between the study sites, caused by a combination of human and environmental factors.

4.5 Summary

The desert-dwelling black rhinos found in the arid areas west of Etosha are rightly regarded as unique animals. The desert-adapted rhinos in the Kunene Region of Namibia provide an extreme example of a population under environmental stress. This population has an average age at first calving of 10.3 years and the inter-calving interval of 44 months. The population has high tourism value, but it is also especially vulnerable to HID due to their low density in an arid environment (Shaw 2002; Hearn 2003; Namibia 2009).

The literature asserts that responsible tourism activities are the alternative answer to mass tourism and its possible potential disturbance of wildlife. This chapter presents results of the testing of the first of two research hypotheses namely that sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos. The hypothesis was tested statistically using data collected on HID forms. Black rhino behaviour and responses to the presence of human activities were taken into consideration in rejecting or accepting the predicted hypothesis.

The HID data were analysed in three phases:

- The first phase involved pre-viewing data which comprises data gathered before the actual tracking of the black rhino started;
- The second phase looked at viewing data comprising the whole tracking process as well as the environmental factors involved; and
- The third phase concerned behavioural data of black rhino behaviour when an animal was located and observed (and it became aware of the trackers).

Disturbance was appraised as a change in normal behaviour during observation. It was found that 65% of the black rhinos observed, changed their normal behaviour and only 23% returned to unaware behaviour after being disturbed. Observer noise caused rhino displacement on 75% of the observation events and the predominant reaction during observation was to run away (61%), which was deemed the most extreme reaction to disturbance.

Several null hypotheses were tested. The first null hypothesis was whether the initial behaviour of black rhinos determined a change in behaviour. The results confirmed that initial behaviour does determine a change in behaviour. Black rhinos were more easily disturbed when they were lying down or standing and they were less likely to be disturbed when they were walking or browsing. The second null hypothesis tested concerned the influence of group composition or the presence of other animals on change in behaviour. The results of the statistical tests lead to the acceptance of the null hypothesis. No statistically significant differences were found to exist for group composition or the presence of other animals in relation to a change in behaviour.

The third possible cause of disturbance is the influence that human presence might have on black rhinos. Results for observer group size were inconclusive due to insufficient variation in numbers as observer group size remained the same throughout the study. The cause of displacement was also inconclusive, due to most of the observations being taken downwind of the rhinos. It was found that most disturbances occurred early during observation events and animals returned to unaware behaviour as time passed. Reactions to human presence were assessed, but no significant difference in reactions could be determined among animals that were displaced. Consequently, the null hypothesis that black rhino disturbance is influenced by observer group size, level of noise, wind factor in relation to observers and time spent was rejected.

The study sites were compared to uncover any intersite differences in black rhino behaviour. No statistically significant change in behaviour between the study sites was found. There were differences in the distance at which rhino became aware of observers and at which distance displacement occurred. Exponential trendlines indicated that there was a 14% rate of increase in the distance when rhino became aware of observers from the Klip River to the Springbok River and the distance where rhino were displaced increased at a rate of 16% between the study sites. Rhino at the Springbok River study site appear to be the most aware and most easily displaced animals. The rhino populations of the Springbok River and Aub/Barab exhibited the most severe reaction to disturbance; that is they had the greatest proportions of animals that were displaced by running away and they were displaced the longest distances. Poacher's Camp had the least severe reaction (they walked toward observers) and the Klip River results were deemed to be insignificant due to the small number of animals studied. The final measure of disturbance was the differences in ranging patterns between the respective study sites. There was a definite difference in home ranges between the study sites. The differences were caused by a combination of human and environmental factors. The null hypothesis that black rhino behaviour was the same for all study sites, was thus rejected.

Given the evidence of HID presented in this chapter the first research hypothesis, namely that sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos was accepted. The following chapter will present the results of tourist perception with regard to black rhino tracking tourism through the testing of the second research hypothesis, namely that tracking of black rhinos contributes beneficially to sustainable community-based ecotourism.

CHAPTER 5: TOURIST PERCEPTIONS OF TRACKING BLACK RHINO

5.1 Introduction

The wide range of values that black rhinos can contribute to land management was pointed out earlier in this study including the enormous monetary value in photographic- and trophy-hunting tourism. Tourism and sustainable development might ultimately contribute to the salvation of black rhinos because they are highly valued as an endangered species (Namibia 2009).

The expansion of rhino habitat into communal land and conservancies is contributing to consumptive and non-consumptive tourism, as well as the net benefit resulting from this. The Kunene region of Namibia is such an area attracting consumptive and non-consumptive tourism. Consumptive tourism is mainly through trophy-hunting operations and the non-consumptive form is through tourism safari operations. In the various study sites, non-consumptive tourism is only practised in the Palmwag Concession Area where the main form of tourism is photographic tourism. The Torra and #Khoadi-//Hôas Conservancies practise both forms of tourism. The attractions in north-west Namibia encompass a combination of wildlife, scenic, wilderness, cultural and historic attractions with the main attractions being desert elephants and rhinos and the Himba culture (Sibalatani 2004; Spenceley & Barnes 2005; Save the Rhino Trust 2005).

This chapter presents and discusses the findings of analyses of questionnaire data obtained from tourists to the Kunene region about their perception of black rhino tracking. The enquiry focuses on the following two objectives:

- To examine and describe tourist perceptions of tracking black rhinos in the three conservation areas; and

- To investigate and describe the probable income-generating benefits of tracking black rhinos (as a high-value species) to promote sustainable community-based tourism.

The hypothesis to be tested that relates to these objectives is that tracking of black rhinos contributes beneficially to sustainable community-based ecotourism.

5.2 Profile of respondents

Questionnaires were distributed at four safari lodges in the study area between June and August 2006. Three of the lodges are operated by Wilderness Safaris, namely Rhino Wilderness Camp, Palmwag Lodge and Damaraland Camp (Wilderness Safaris 2009). Rhino Wilderness Camp and Palmwag Lodge are both situated in the Palmwag Concession Area. Damaraland Camp is situated in the Torra Conservancy, which borders #Khoadi-// Hoas Conservancy and the Grootberg Lodge is in #Khoadi-// Hoas Conservancy.

A total of 5507 tourists visited the four safari lodges in the three months during which the survey was done (Du Raan 2007, pers comm; Freygang 2007, pers comm). A response rate of 50% for the 400 questionnaires distributed was achieved. Fifty-five per cent of respondents were male and 45% were female. The mean age of respondents was 41.3 years with a range of 11 to 79 years. The respondents grouped in six nationality categories as set out in Table 5.1.

West European nationalities were combined as the European Union (EU) and this EU group accounted for the majority of respondents (63.5%). A single respondent (0.5%) from Swaziland comprised the “other” category. The large EU and USA contingents imply a substantial injection of foreign currency into the study area.

Table 5.1: Nationality of respondents in the tourist perception survey

	Nationality						
Lodge	**EU %***	**RSA %**	**USA %**	**AUS %**	**Namibia %**	**Other %**	**N**
Grootberg Lodge	10	3	0	0	0	0	26
Damaraland Camp	2	0	1.5	1.5	0	0	10
Rhino Camp	6	0	2.5	0	0	0	17
Palmwag Lodge	45.5	11.5	7	2.5	6.5	0.5	147
Total	63.5	14.5	11	4	6.5	0.5	200

* EU nationalities: British; Dutch, French; German; Belgian; Czech; Irish; Italian; Spanish

Source: Questionnaires

The majority (73.5%) of respondents were guests at Palmwag Lodge. An explanation for this is the proximate location of the lodge to the research headquarters which were housed in the SRT offices, located within one kilometre from the Palmwag Lodge. This enabled the researcher to monitor frequently and encourage a good response rate from this particular lodge. The other lodges required long drives by vehicle so that monitoring could not be done as frequently.

Sixty-six per cent of the respondents were visiting Namibia for the first time and for 74% it was their first visit to the Kunene region. Conversely, 34% and 26% of respondents had respectively visited Namibia and the Kunene region (north-west Namibia) previously. It emerged that tourists who have visited the country and the region before were returning on a regular basis. The mean number of times that respondents had been to Namibia before was 4.6 with a range between one and 20 times (sd=5.1). The comparative results for the Kunene region were almost identical with a mean of four and a range of one to 20 times (sd=4.6).

The mean intended stay in Namibia was 17.6 days with a range between two and 30 days. The mean intended stay in the Kunene region was significantly shorter at 5.1 days and the range was one to 16 days. The findings about intended stay in Namibia and the Kunene region indicate that the majority of respondents are on extended tours through the country and the visit to the Kunene region is part of a safari package. Sibalatani (2004) found that only 8% of tourists visiting the Kunene region arrange their trips independently, while 88% used travel agents.

The respondents were asked to state what their reasons were for visiting Namibia and the Kunene region. The responses are summarized in Table 5.2.

Table 5.2: Reasons for visiting Namibia and the Kunene region

Question	**Themes**	**N**	**%**
Reason for visiting Namibia	Scenery/Landscape	64	32
	Wildlife/Safari	86	43
	Cultural	35	18
	Stability/Safe/Accessible	9	5
Reason for visiting Kunene region	Scenery/Landscape	42	21
	Wildlife/Safari	62	31
	Camping	3	2
	Rhino	40	20
	Elephant	21	11
	Local culture	36	18
	Passing through	12	6

Source: Questionnaires

The main reasons for visiting Namibia were to see its wildlife or to have a safari experience followed by a wish to see the landscape and/or scenery. These were also the main reasons for visiting the Kunene region. The intention of seeing rhino and experiencing local Himba culture were important reasons for visiting north-west Namibia. Experiencing the country's culture was also an important reason to visit Namibia.

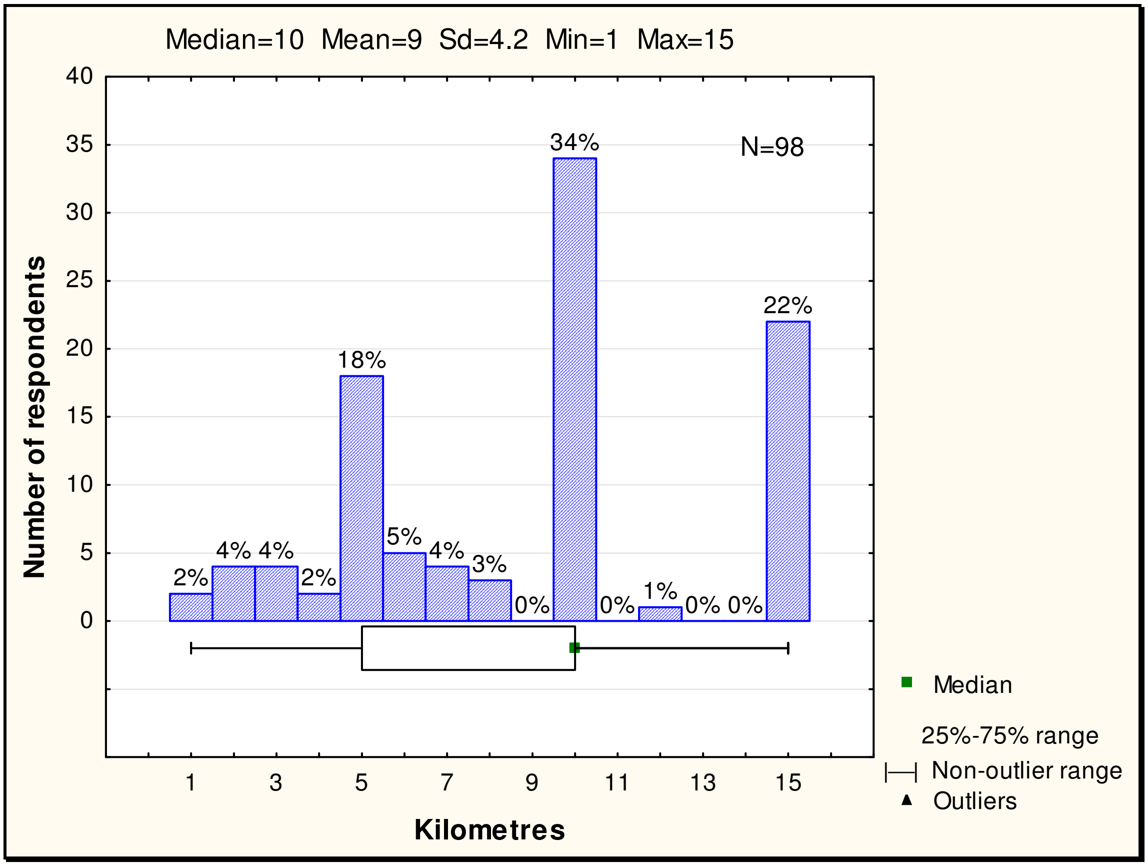
5.3 Rhino-tracking tourism

Tracking of black rhinos is currently undertaken from two of the four lodges in the study area. The Rhino Wilderness Camp was the first lodge to introduce rhino tracking tourism. The camp, owned by Wilderness Safaris, entered a joint venture with SRT to initiate the tracking of black rhinos. The express aim of this joint venture is to use tourism as a direct means of supporting the monitoring costs of rhino conservation in the area, while directly linking rhino conservation goals to regional development and economic growth. The camp operates in an area of approximately 150 000 ha in conjunction with the SRT tracking team that collects rhino positional and identification data while recording the level of disturbance at each sighting as part of ongoing research into the impacts of tourism on black rhinos (Hearn 2003; Spenceley & Barnes 2005). The other lodge offering rhino tracking is the Grootberg Lodge in the #Khoadi-//Hoas Conservancy. The Grootberg Lodge received their first two rhino bulls during the study period and only started with rhino tracking in this time. The Palmwag Lodge and Damaraland Camp did not participate in black rhino tracking during the study period. Responses in questionnaires filled in by visitors to these lodges would not be influenced by the fact that these lodges did not conduct black rhino tracking because the majority of respondents were on a safari package (as indicated in section 5.2).

The importance of black rhinos as a tourist attraction to the Kunene region was examined for two categories of respondents, namely those who had never done black rhino tracking, and those who had. The responses of those two groups of tourists are discussed in the next two sections respectively.

5.3.1 Respondents who have never done black rhino tracking

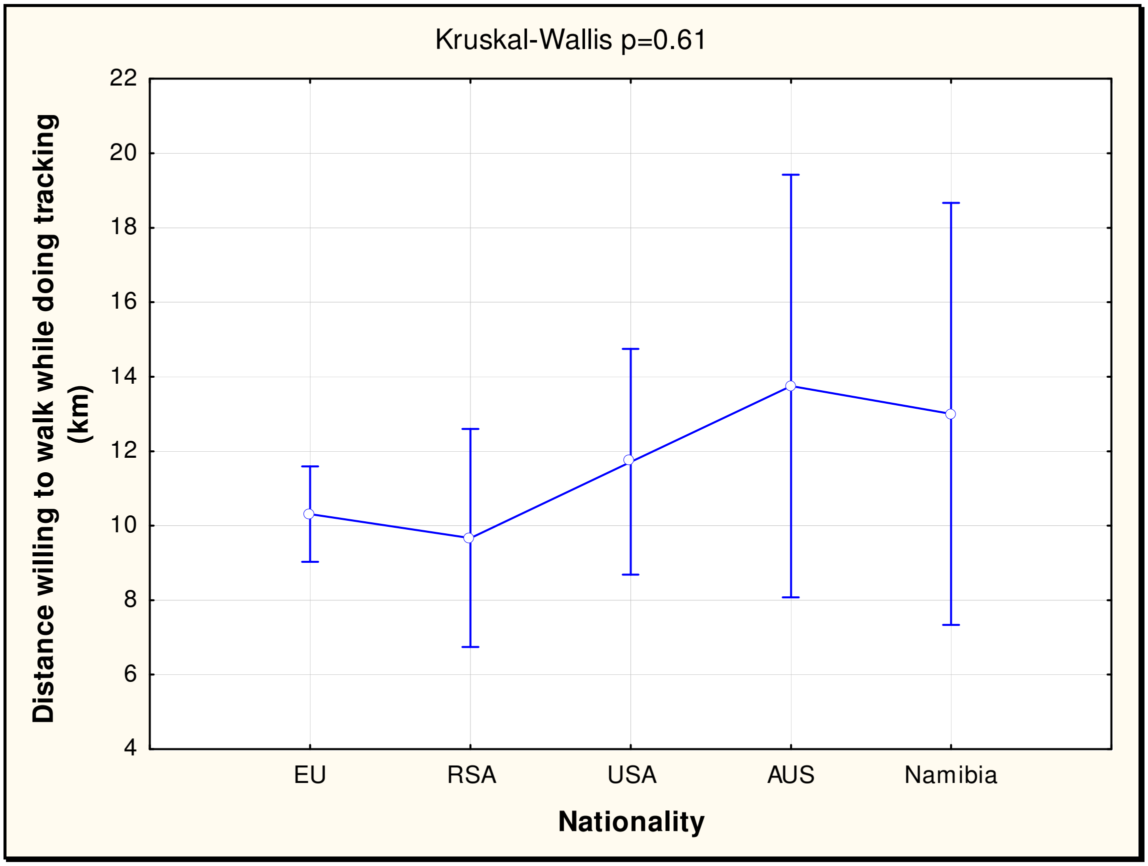
Seventy-nine per cent of the respondents had never done black rhino tracking, but 77% of them voiced interest in participating in black rhino tracking and only 23% of respondents had no interest in such activity. The expressed interest in black rhino tracking is reflected in the distance respondents were willing to walk as presented in Figure 5.1.



Source: Questionnaires

Figure 5.1: Distance (km) respondents are willing to walk tracking rhinos

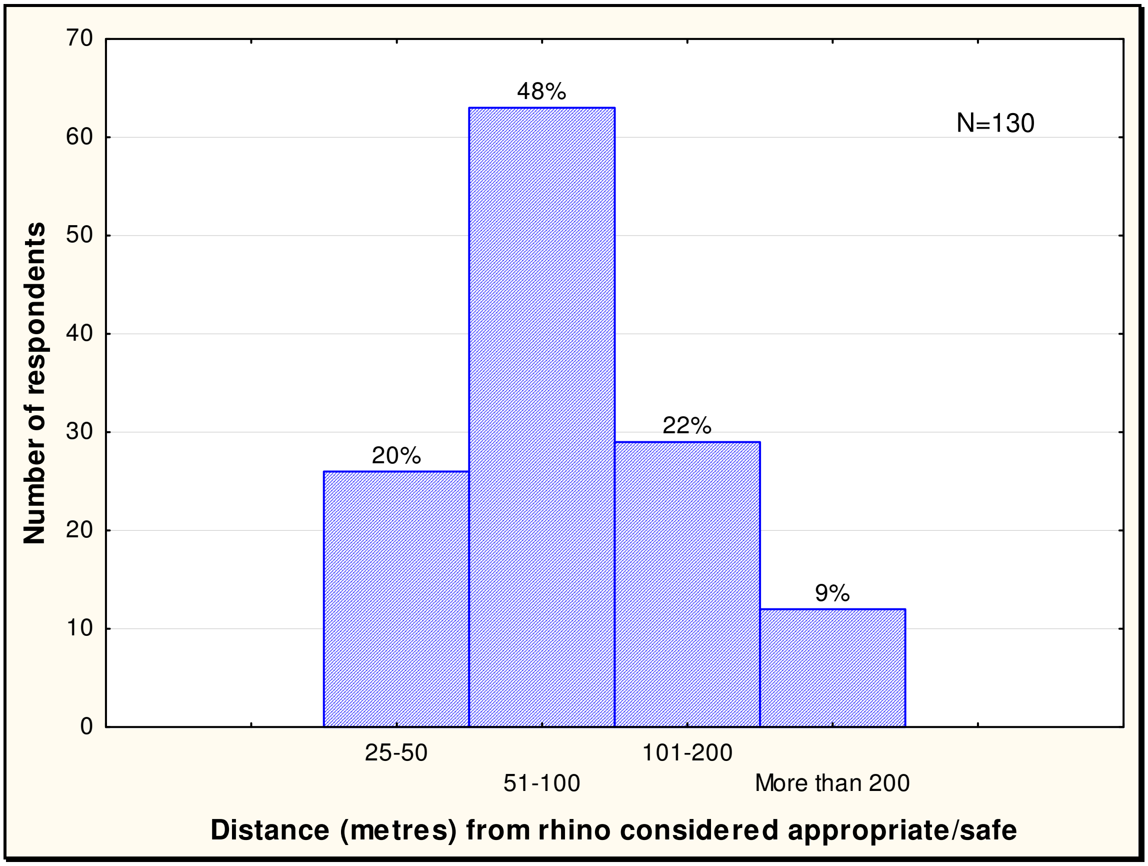
The mean distance respondents were willing to walk was 9 km with a range of one and 15 km. A distance of 9 km is deemed feasible, given the terrain involved and the mean age of the respondents who have never taken part in rhino-tracking (41.3 years). The distance people of different nationalities are willing to walk is illustrated in Figure 5.2 showing that Australians, followed by Namibians, were willing to walk the longest distances during rhino-tracking.



Source: Questionnaires

Figure 5.2: Distance persons of various nationalities were willing to walk during rhino-tracking

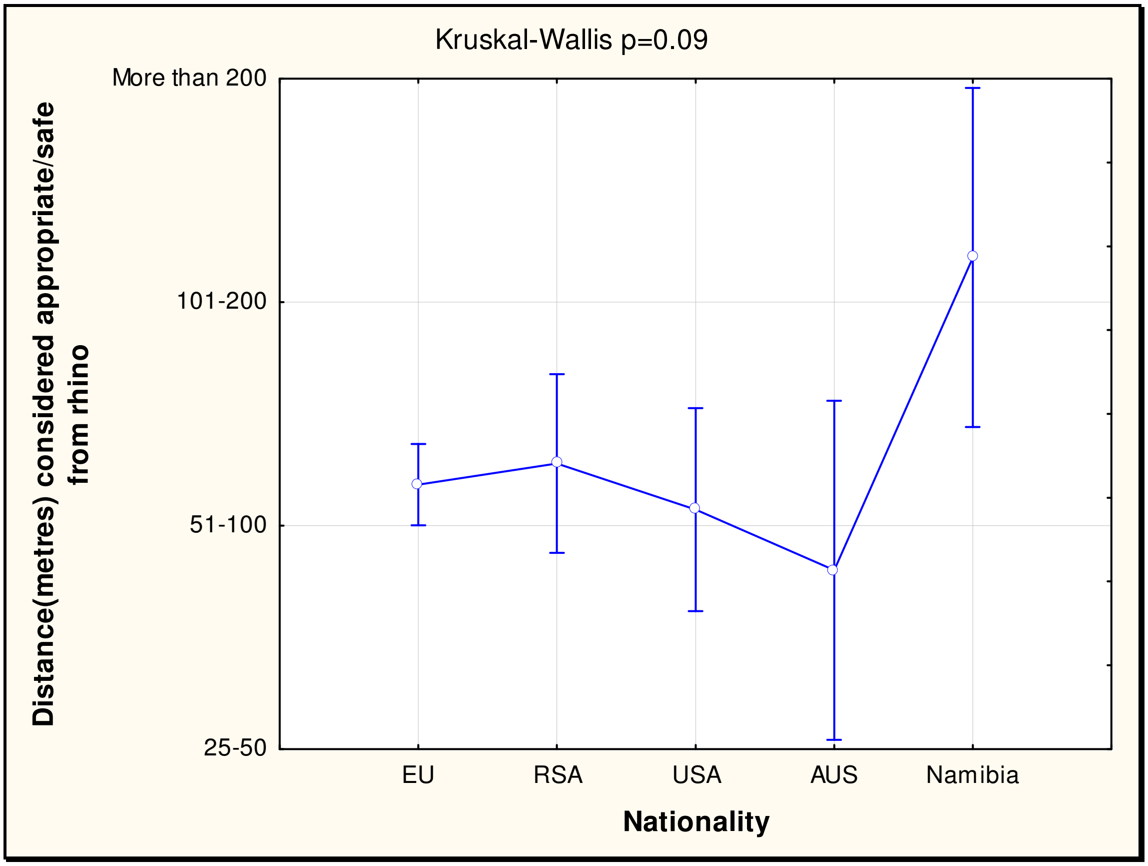
The Kruskal-Wallis test was done to determine whether there is a statistically significant difference between respondents' nationalities and distance they were willing to walk. No significant difference was found to exist (Kruskal-Wallis p=0.61). The distance respondents consider appropriate or safe to approach black rhino was asked. Nearly half (48%) responded that 51 to 100 m is the desired safe distance (Figure 5.3).



Source: Questionnaires

Figure 5.3: Distance respondents considered appropriate/safe

Being closer than 25 metres is deemed to be unsafe and liable to cause disturbance to the animal and was not given as an option in the questionnaire. The distance considered appropriate/safe by respondents of different nationalities varied from Namibians who perceived the greatest distances from the rhino to Australians who are prepared to venture the closest (see Figure 5.4).



Source: Questionnaires

Figure 5.4: Distance considered appropriate/safe to approach rhinos according to nationalities of respondents

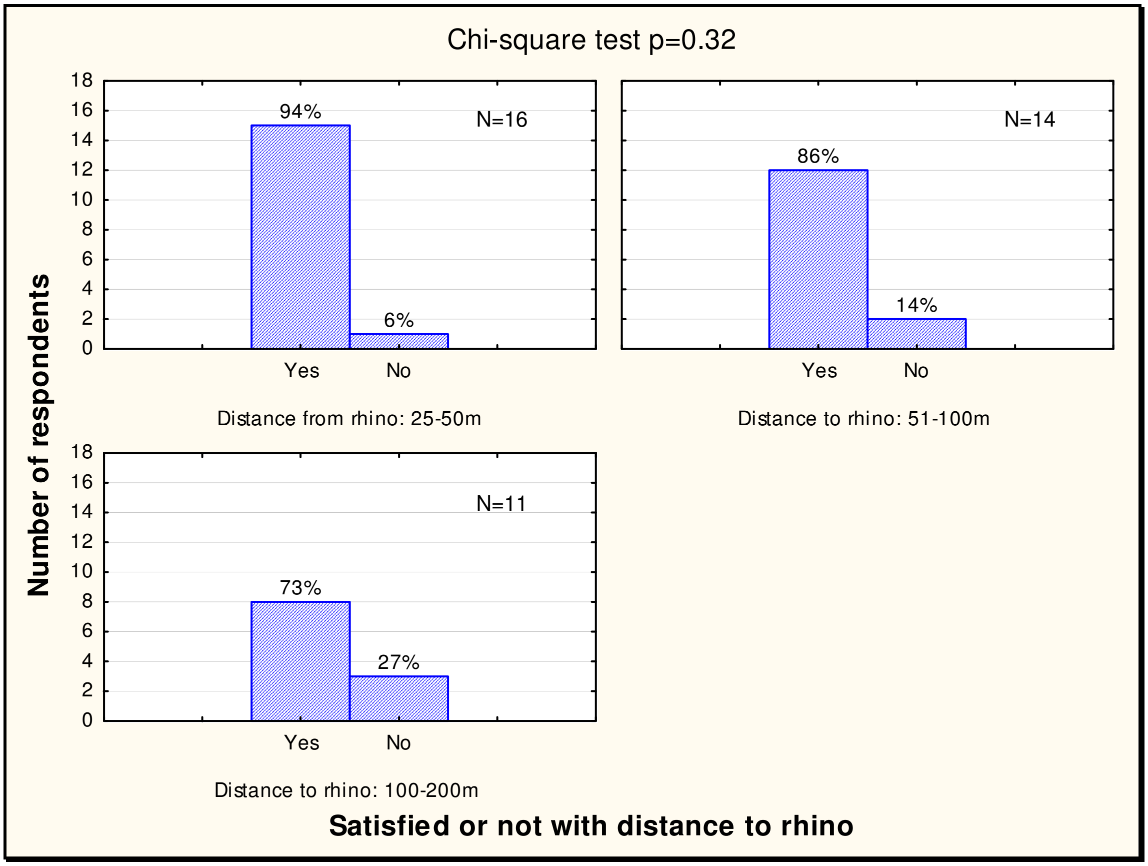
The Kruskal-Wallis statistical test indicated a statistically significant difference between the distance respondents, from different nationalities considered appropriate/safe from rhino (Kruskal-Wallis p=0.09). The results could indicate that Namibian respondents have a better knowledge of black rhino behaviour and they are aware of the possible risk of approaching such dangerous animals.

Findings about respondents who have not done black rhino tracking tourism are that the majority of them would want to, and that there are no significant differences between nationalities regarding their willingness to walk a feasible distance. It was found that there is a significant difference between nationalities regarding their attitude toward safe or appropriate distances to approach rhino which appear to signal a naivety on the part of foreign tourists.

5.3.2 Respondents who have done black rhino tracking

Twenty-one per cent of the 200 respondents had undertaken black rhino tracking previously but the majority (79%) had not taken part in this activity before. The majority (73%) of respondents that did rhino tracking were doing it for the first time. The duration of tracking episodes until a rhino is located varied between the respondents. Forty per cent stated that the duration exceeded 90 minutes, 38% spent between 31 and 60 minutes and the remainder's experience lasted less than 30 minutes (18%) or more than an hour (4%). The mean time of locating black rhino by the research team was 55 minutes with the aid of telemetry equipment.

Thirty-nine per cent of the respondents estimated the distance between them and the rhino to be 25 to 50 metres, 34% at 51 to 100 metres and 27% at 101 to 200 metres. Asked whether they were satisfied with the distance to the rhino, 85% answered that they were. Those who were not satisfied gave "too close" (5%) or "not close enough" (10%) as reason for their dissatisfaction. The sparse vegetation and lack of other cover as well as wind are factors that influence the distance at which a rhino can be approached. Figure 5.5 records the satisfaction or not of respondents with different distances from the rhino. A chi-square test for the goodness of fit between varying distances from the rhino and whether respondents were satisfied was performed. The test showed differences in distance from the rhino were not statistically significant in determining respondents' satisfaction or not (p=0.32). Figure 5.5 does give an indication of a decrease in number of respondents being satisfied as distance from the rhino increases.



Source: Questionnaires

Figure 5.5: Respondents' satisfaction with distance from rhinos

Ninety-four per cent of respondents were satisfied at 25 to 50 m from the rhino, while 86% were satisfied at 51 to 100 m and 73% at 101 to 200 m. The majority of respondents were satisfied no matter how far they were from the rhino, but there is a definite lower number of respondents satisfied from further away.

The following section reports on the value of rhino tracking for ecotourism in the Kunene region.

5.4 Value of rhino-tracking for ecotourism

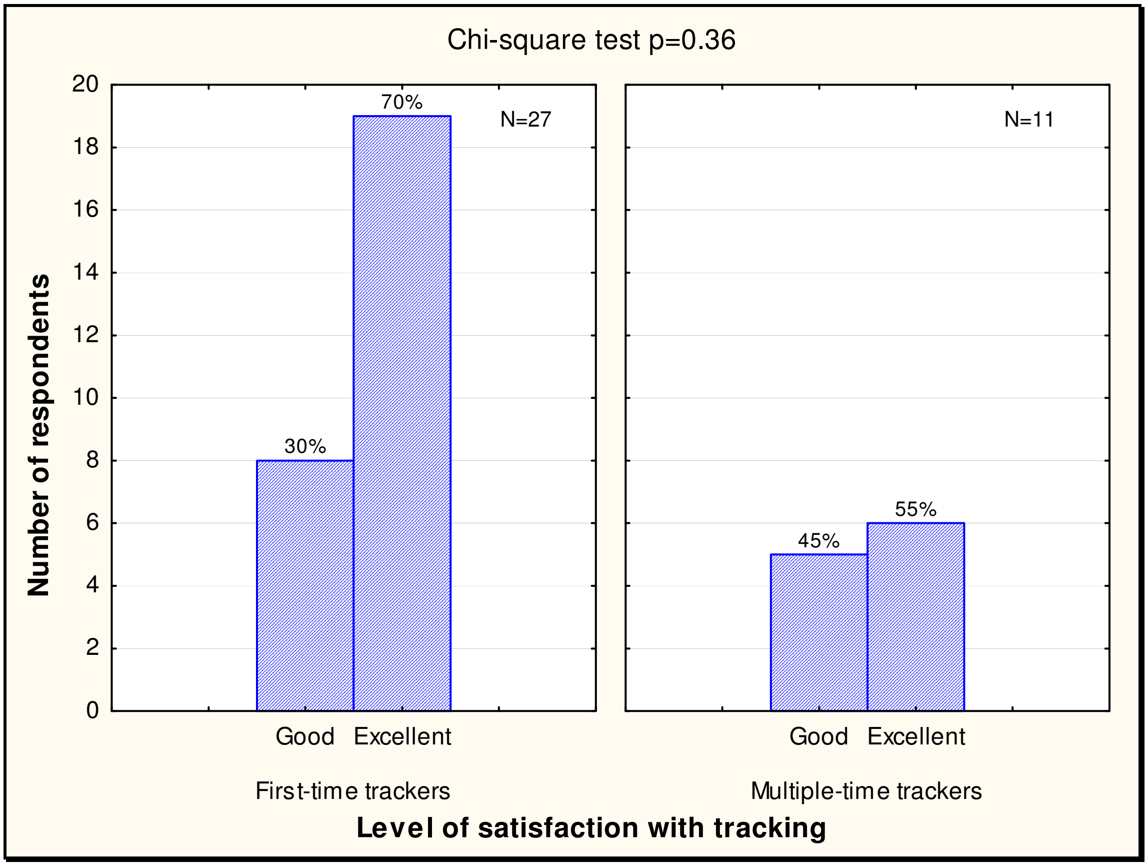
The value of black rhino tracking for ecotourism in the Kunene region was assessed by considering the attractiveness of the tracking experience and its monetary value. The attractiveness of the tracking experience was addressed by testing seven null hypotheses about the level of satisfaction with the tracking experience and the willingness of respondents to return for repeat trackings. The monetary value was gauged by looking at the amount (in US$) that respondents are willing to pay to participate in rhino tracking.

5.4.1 Attractiveness of rhino-tracking to tourists

The findings of section 5.3 were used to formulate the following null hypotheses:

- Rhino-tracking first-timers have a higher level of satisfaction than many-timers;
- The shorter the tracking time the higher the level of satisfaction;
- The closer the respondents approached the rhino the higher the level of satisfaction;
- Respondents who do rhino-tracking for the first time are willing to return;
- Respondents who have a shorter tracking time are willing to return;
- Respondents who approached closer to the rhino are willing to return; and
- Respondents with a higher level of satisfaction are willing to return.

The first null hypothesis is tested by looking at data on rhino trackers' levels of satisfaction with their tracking experience. Figure 5.6 shows the levels of satisfaction.

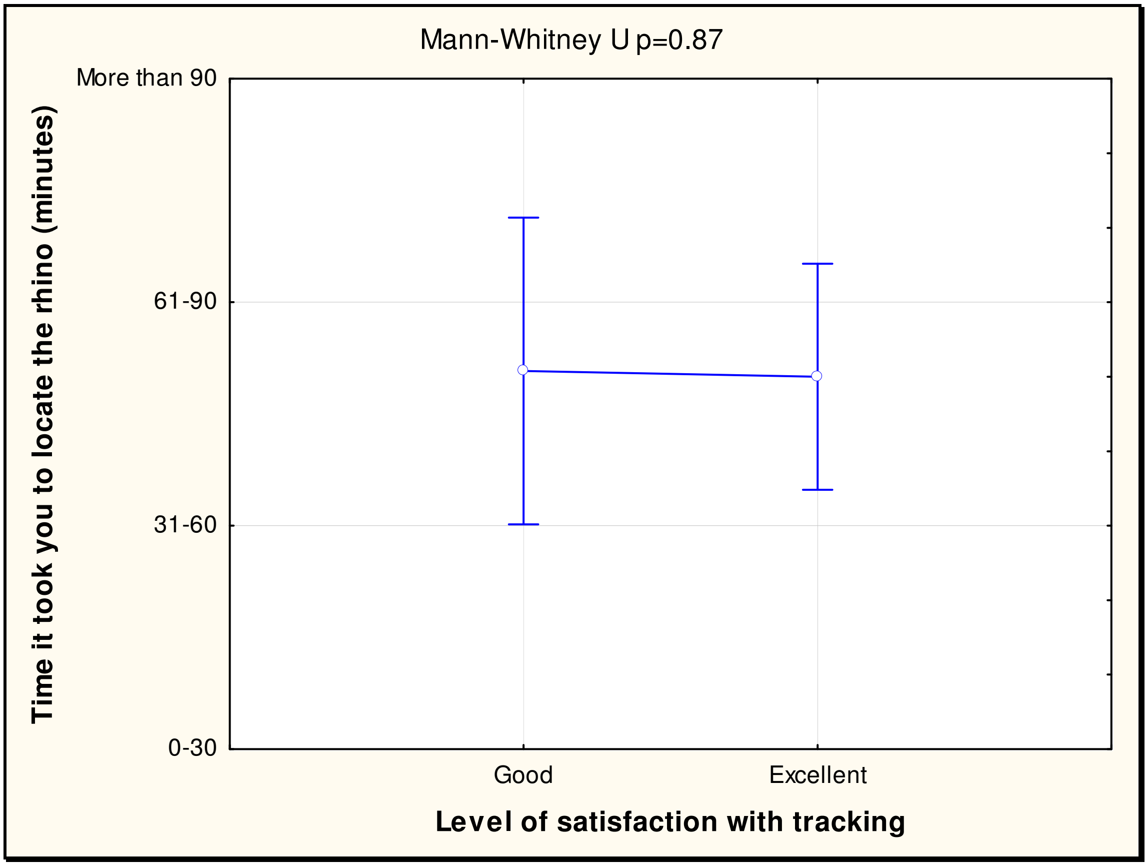


Source: Questionnaires

Figure 5.6: First-time rhino-trackers and their level of satisfaction compared to multiple-timers

A chi-square test of goodness of fit was applied to determine whether first-time rhino-trackers have higher levels of satisfaction with their tracking experience. The test results lead to a rejection of the null hypothesis. (p=0.36). A very large proportion (70%) of first-time trackers rated their experience as excellent but this did not differ significantly statistically from the many-timers who also rated their experience to be excellent

The null hypothesis that tracking time influences the level of satisfaction was tested (see Figure 5.7).

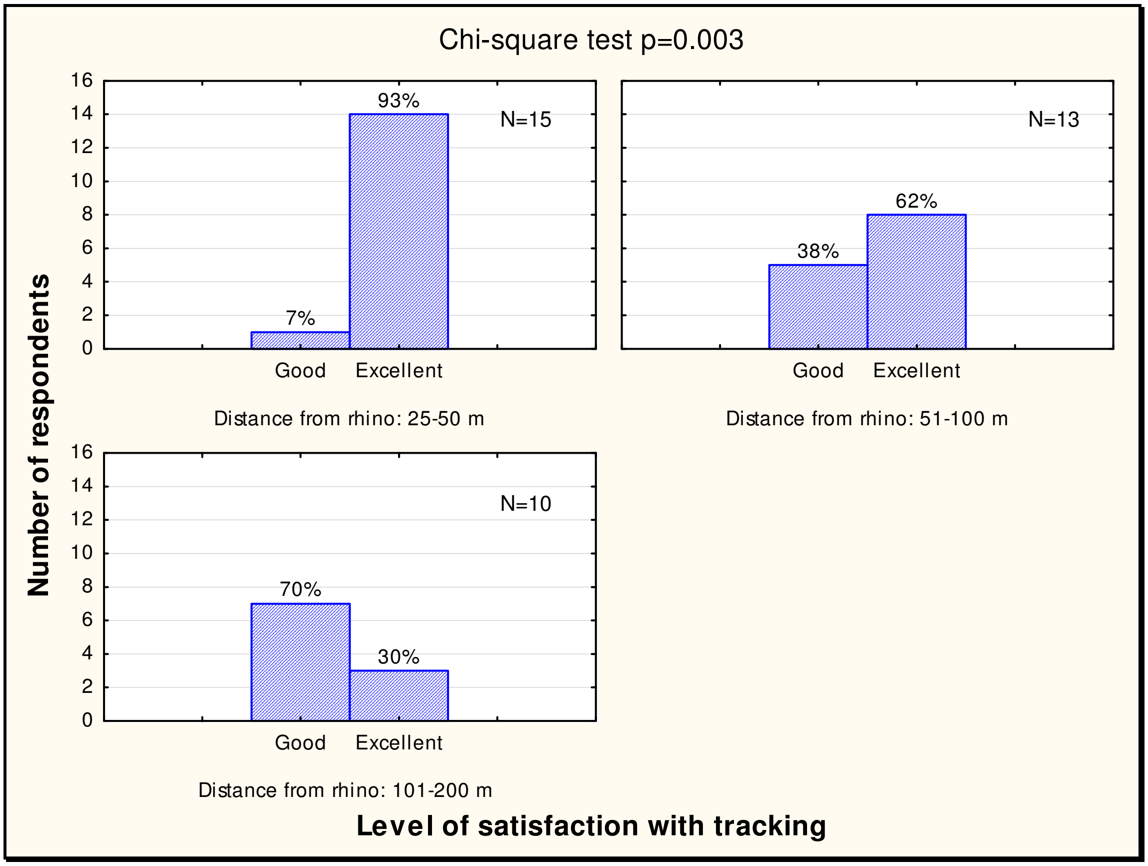


Source: Questionnaires

Figure 5.7: Level of satisfaction in relation to tracking time

The Mann-Whitney U test was used to test the level of satisfaction against the tracking time and no statistically significant difference in the tracking time and the level of satisfaction was found (Mann-Whitney U p=0.87).

The third null hypothesis stated that respondents who approached closer to the rhino have a higher level of satisfaction. The chi-square test was applied to determine the goodness of fit between the two distributions (see Figure 5.8).

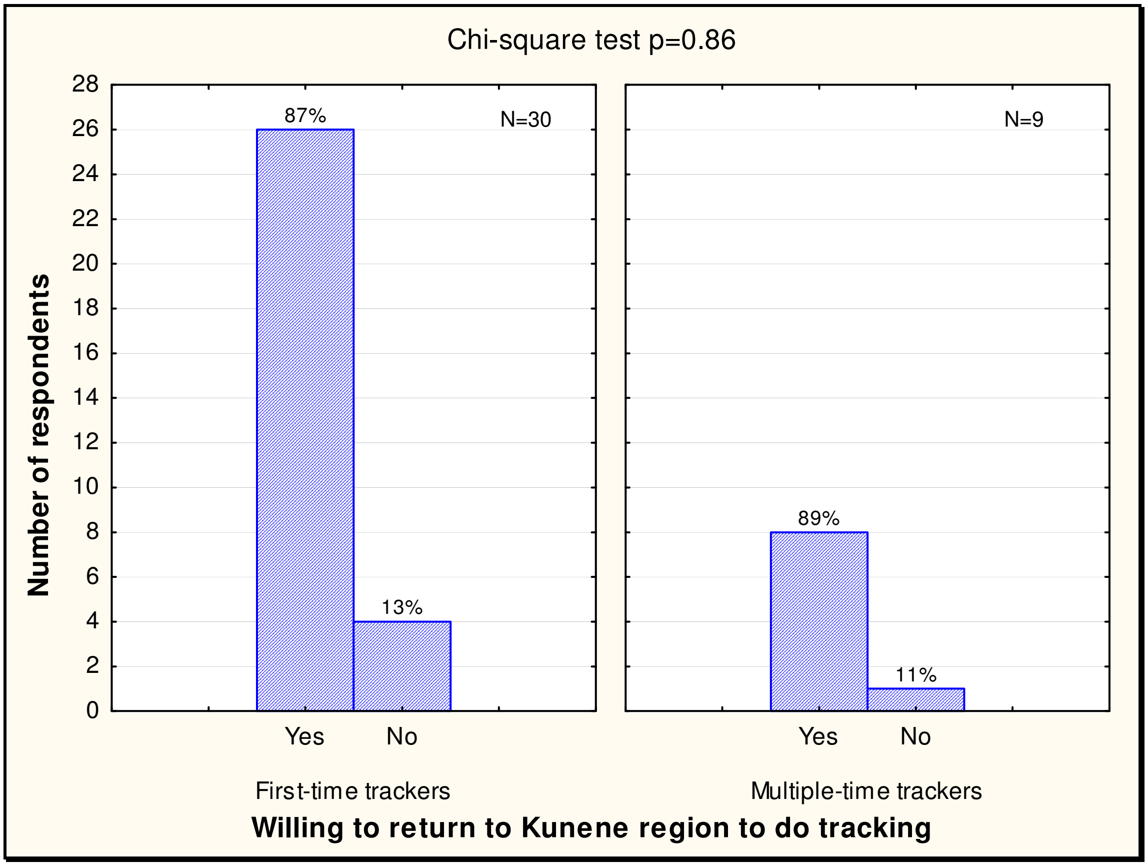


Source: Questionnaires

Figure 5.8: Level of satisfaction in relation to distance from rhinos

The chi-square test indicates a highly significant difference in level of satisfaction compared to distance from the rhino (p=0.003). The level of satisfaction is strongly influenced by the distance that respondents were from the rhino. The closer respondents were to the animal, the higher the level of satisfaction with the tracking experience. This corresponds with findings in Asia and other African countries where tourists were most interested in seeing large and dangerous animals and the closer the better (Kerley, Geach & Vial 2003).

The willingness of tourists to return for tracking was tested by the fourth null hypothesis, namely whether first-time trackers were willing to return for tracking (see Figure 5.9).

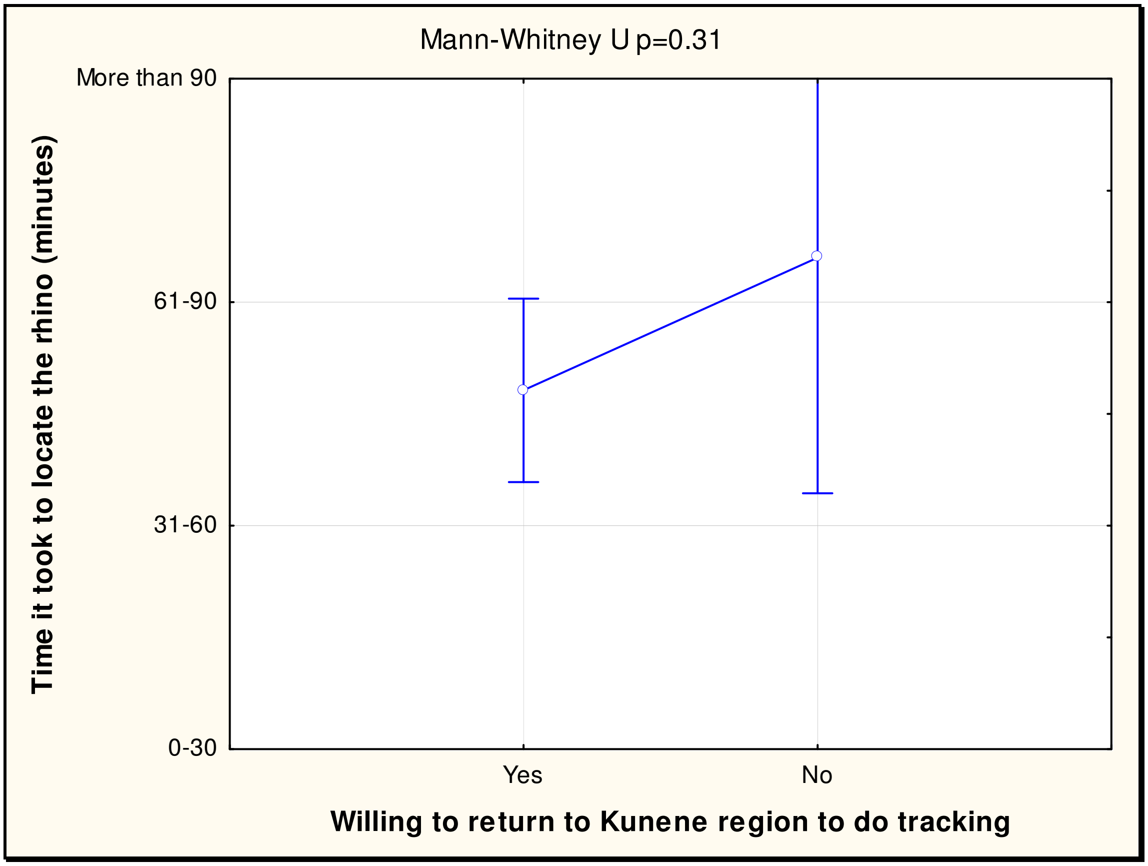


Source: Questionnaires

Figure 5.9: First-time rhino-tracking and the willingness to return for the activity compared to multiple-timers

A chi-square test was done for goodness of fit to determine whether first-time rhino-trackers are willing to return for rhino-tracking. The results confirm the null hypothesis that tourists tracking black rhino for the first time are willing to return for the activity (p=0.86). The determining factor of whether respondents would return for rhino-tracking was not based on number of times that the respondent has done tracking.

The question whether tracking duration influences the willingness of respondents to return for tracking was addressed and the results are presented in Figure 5.10.



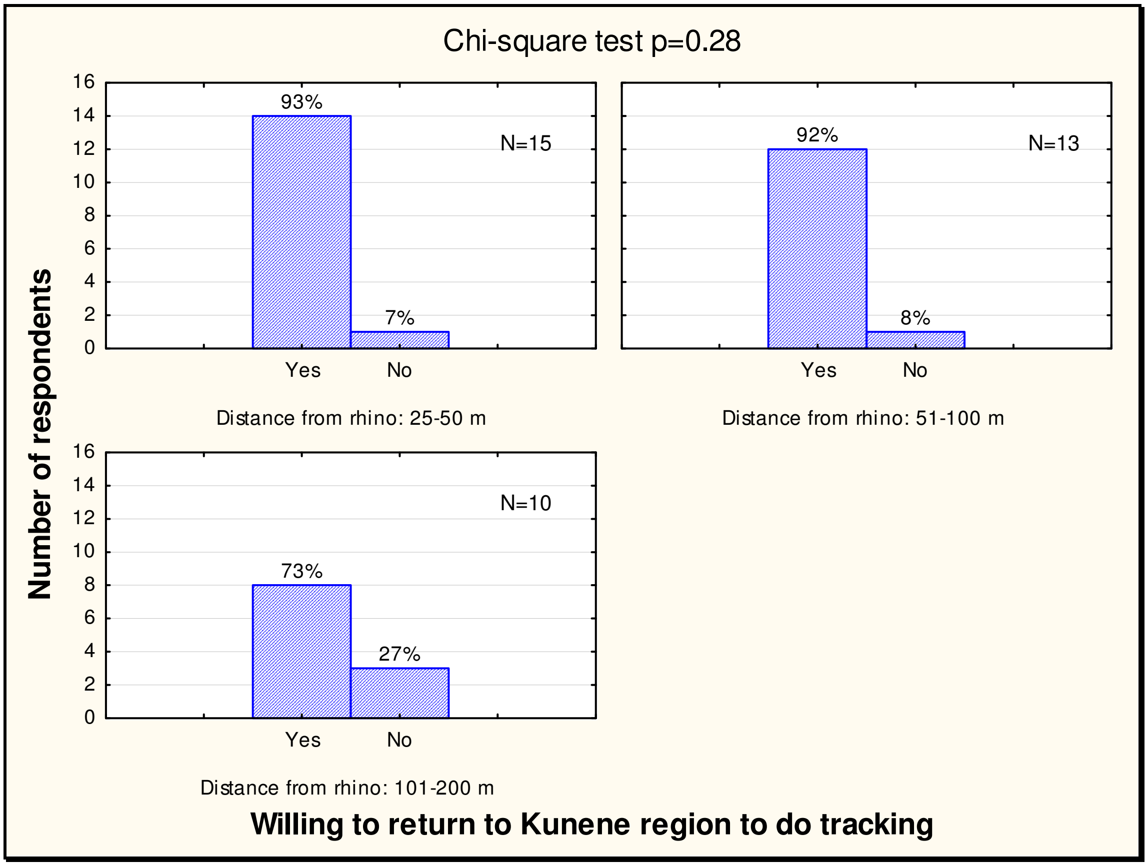
Source: Questionnaires

Figure 5.10: Willingness to return in relation to tracking time

The Mann-Whitney U test was used to compare the willingness of respondents to return to the area to do tracking again against the time it took to locate the rhino. The test indicated no statistically significant difference between tracking duration and willingness of respondents to return for the activity (Mann-Whitney U p=0.31).

Although the results indicate that respondents were less inclined to return when tracking duration was longer, they were not statistically significant. Evidently, the tracking duration does not affect the decision to return for the activity.

Respondents' willingness to return for further rhino-tracking was also examined regarding the distance from the rhino to which they approached. Results are presented in Figure 5.11.



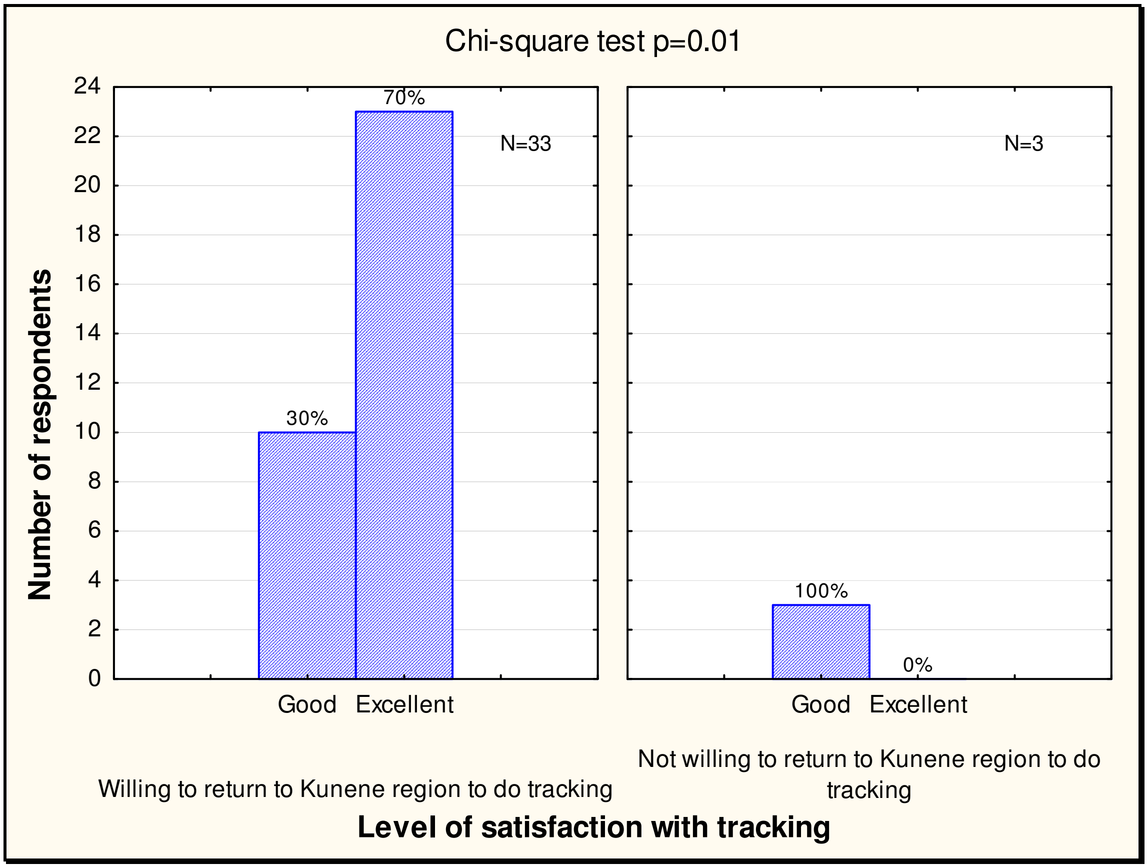
Source: Questionnaires

Figure 5.11: Willingness to return in relation to distance from rhinos

A chi-square test for goodness of fit was used to test the sixth null hypothesis. The test indicated no statistically significant difference between the distance to the rhino and the willingness of respondents to return for tracking (p=0.28).

Results of the test for level of satisfaction in relation to distance from the rhino indicated a significant difference in relation to distance. Respondents reported a higher level of satisfaction the closer they got to the rhino. Distance from the rhino did, however, not influence the willingness of respondents to return for more rhino-tracking.

The final null hypothesis tested was that higher levels of satisfaction would result in respondents returning for tracking. Figure 5.12 presents the results.



Source: Questionnaires

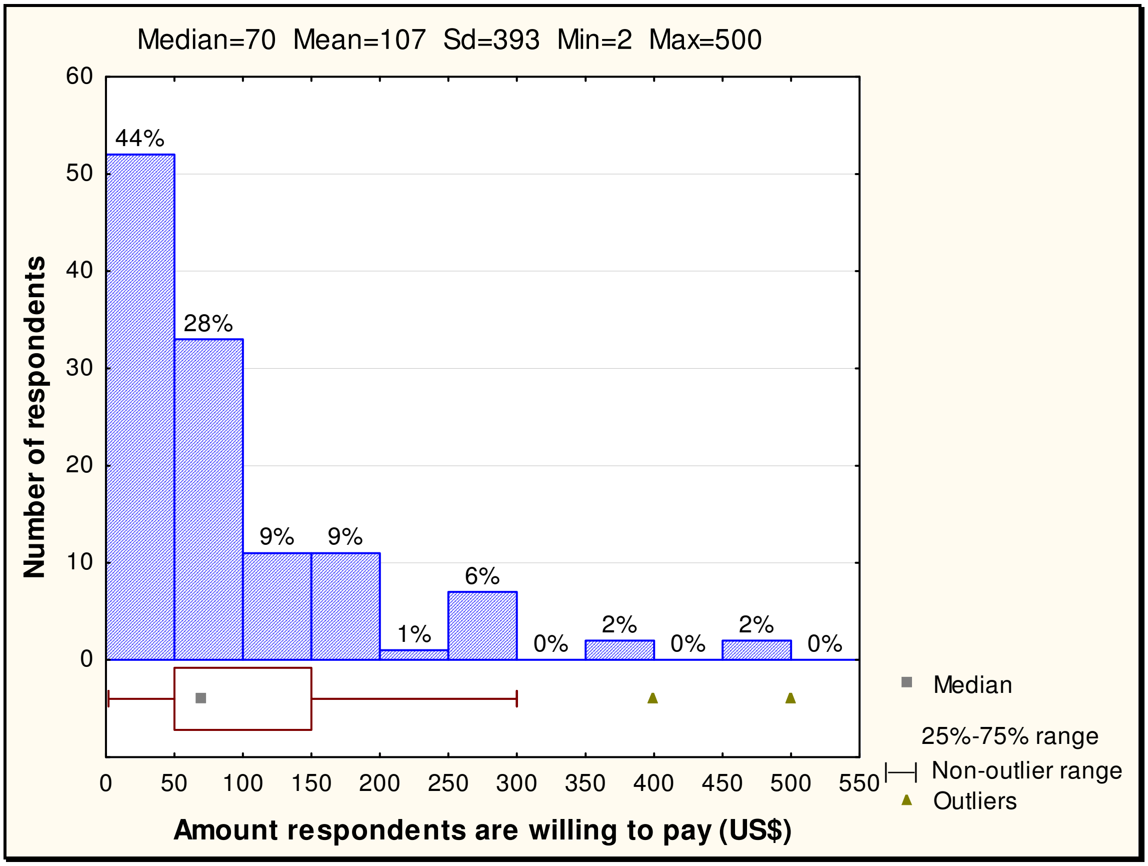
Figure 5.12: Willingness to return in relation to level of satisfaction with tracking experience

A chi-square test indicates that the determining factor for the willingness of respondents to return is the level of satisfaction with the tracking experience. The test confirmed that there is a statistically significant difference in the level of satisfaction and the willingness of respondents to return for tracking (p=0.01).

The investigation indicates that the attractiveness of black rhino tourism is determined by the level of satisfaction with the tracking experience. The attractiveness of black rhino-tracking was evaluated through the variables of level of satisfaction and willingness of respondents to return for another tracking experience. The willingness to return was only influenced by the level of satisfaction with the tracking experience and the only factor determining the level of satisfaction was the distance to the rhino. Thus, the single determining factor in the attractiveness of rhino-tracking is how closely the rhino can be approached.

5.4.2 Monetary value of rhino-tracking

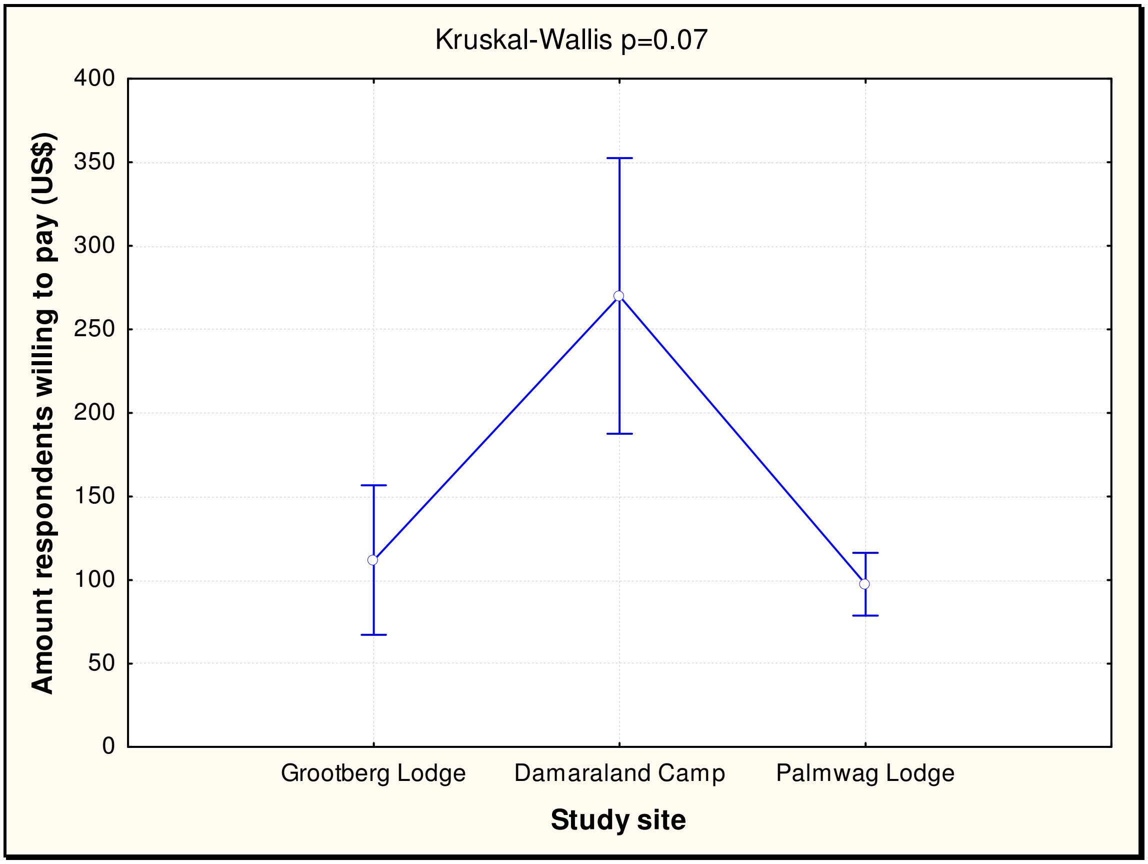
The monetary value of rhino-tracking was assessed by the amount that respondents were willing to pay for a day's safari. The average daily rate at Rhino Wilderness Camp was US$223 per person for a night's full board at the camp during the study period. Tracking at Rhino Wilderness Camp is only provided to guests who stay at the camp. Wilderness Safaris estimated that rhino-tracking would cost tourists US$129 for a day's safari which would include drinks and lunch. Grootberg Lodge started rhino tracking toward the end of the study period. The rate for a day's safari, including lunch and refreshments was US$118 (Spenceley & Barnes 2005; Du Raan 2007, pers comm). Figure 5.13 illustrates the amount that respondents were willing to pay for a day's safari on which they do radio telemetry tracking of black rhino in a communal conservancy.



Source: Questionnaires

Figure 5.13: Amount (US$) respondents were willing to pay for a rhino-tracking safari

Respondents were willing to pay a mean rate of US$107 for a day safari tracking black rhino in the Kunene region of Namibia (sd=393). The median amount is US$70 per day of rhino tracking. The amount respondents were willing to pay was examined for the three lodges that were only starting with black rhino tracking or were not conducting rhino safaris (see Figure 5.14).



Source: Questionnaires

Figure 5.14: Amount (US$) respondents are willing to pay for rhino-tracking at three study sites

Respondents at Damaraland Camp in the Torra Conservancy were willing to pay the largest amount for a day safari of rhino-tracking. The Kruskal-Wallis test was used to determine the statistical significance of difference between the three lodges where rhino-tracking tourism was not being offered at beginning of the study period. The results were not statistically significant (Kruskal-Wallis p=0.07). Figure5.14 clearly indicates how much more respondents at Damaraland Camp were willing to pay for rhino-tracking in comparison to the other two lodges' guests.

The mean rate of US$107 that respondents in this study were willing to pay for a day's safari is below the daily rate stipulated by Wilderness Safaris (US$129) and Grootberg Lodge (US$118), but the difference is not substantial. Consideration of the lodges' fees suggests that Damaraland Camp potentially has the greatest opportunity to conduct rhino-tracking according to the amount tourists were willing to pay.

5.5 Summary

Spenceley & Barnes (2005) found in surveys of tourists in South Africa and Namibia that 7-14% of total wildlife-viewing income can be ascribed to rhinos. The “desert” rhinos of the Kunene region are an important population in conservation terms and they contribute significantly to drawing visitors to the area. The presence of rhinos is very important to the area in creating jobs in tourism lodges and camps for visiting tourists (Hearn 2003).

The literature study confirmed the importance of the CBNRM programme in Namibia and its resultant conversion of large tracts of land for wildlife and tourism. Rhinos are an important catalyst in attracting donor funds to the CBNRM programme in Namibia (Spenceley & Barnes 2005). This chapter has presented the results of the testing of the second of the two research hypotheses, namely that tracking of black rhinos contributes beneficially to sustainable community-based ecotourism. The hypothesis was tested using questionnaire data collected from tourists at selected lodges.

The respondent profile showed that the majority of respondents were foreign tourists, specifically from the EU and they were visiting Namibia for the first time. The intended stay in the Kunene region was substantially shorter than the stay in the country, indicating that the majority of respondents were on safari tours through Namibia. The main reasons for visiting Namibia and the Kunene region were for experiencing wildlife and a safari, followed by a desire to see the unique scenery and landscape. An important attraction to the Kunene region was the precence of rhinos, something which 20% of respondents specified as their reason for visiting there.

Further analysis was conducted on rhino-tracking tourism. Respondents were divided into those who had not done rhino-tracking before and those who had. The majority of respondents who had never taken part in this activity said that they would want to. There were no significant differences between the nationality of respondents and the distances that they deemed feasible and which they were willing to walk. The research indicated that there was a significant difference in the attitude toward distances from the rhino between nationalities, which could indicate naivety on the part of foreign tourists. Results from respondents who have done black rhino tracking indicated that the minority of tourists to the area have participated in this activity before and the majority were doing it for the first time. The tracking time and perceived distance to the rhino varied significantly among respondents with the majority being satisfied with the distance to the animals. There was no distance to the rhino that was deemed unsatisfactory.

The value black rhinos hold for ecotourism was assessed according to the attractiveness of rhino tracking to tourists and the monetary value of the activity. The only significant factor in the decision of tourists to return was their level of satisfaction with the tracking experience. The distance between them and the rhino was the motivating factor in this decision. The analysis of monetary value of black rhino tracking indicated that tourists were willing to pay an amount of US$107 for a day's safari. Comparison of the lodges suggested that Damaraland Camp has the greatest potential for conducting black rhino tracking in terms of the amount tourists were willing to pay. The conclusion one must make regarding the hypothesis that tracking of black rhinos could contribute to sustainable community-based ecotourism is that it can be accepted.

The final chapter summarizes the findings, draws conclusions, specifies limitations of the study and makes recommendations about rhino tracking and avenues of further research.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents findings from this study with key management recommendations. Areas requiring further research are identified. This study set out to determine the reciprocal impact between black rhino and community-based ecotourism in north-west Namibia. The research was carried out in three study sites in the Kunene region namely the Palmwag Concession Area, Torra Conservancy and #Khoadi-//Hoas Conservancy. The study sites were selected due to the implantation of radio transmitters in black rhino in these areas and the number of tourists that visit the area. The research attempted to test two prediction hypotheses. One, that sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos and two, that tracking of black rhinos contributes beneficially to sustainable community-based ecotourism. These hypotheses were tested by means of an overarching aim and a number of objectives. The overarching aim of this research was to explore and describe the reciprocal impacts community-based ecotourism efforts and black rhino spatial movement patterns have on one another in three conservation areas in Namibia.

The research objectives, which contributed to the overarching aim, were:

- To review the documented reciprocal impacts between rhino-tracking tourism and rhino conservation through an in-depth literature study;
- To explore, describe and compare three conservation areas in north-west Namibia;
- To observe and describe the effects of human-induced disturbance on the spatial movement patterns of black rhino in the three conservation areas using radio-telemetry tracking and aerial surveys;

- To examine and describe tourist perceptions of tracking black rhino in the three conservation areas; and finally
- To investigate and describe the probable income-generating benefits of tracking black rhinos (as a high-value species) to promote sustainable community-based tourism.

The aim and objectives of the research served as guidelines to conclude the research, to illustrate the limitations of the study and to make recommendations for future research.

6.2 Reciprocal impact between rhino-tracking tourism and conservation

The demand for rhino horn from Asia and the Middle East persists and the threat of a return to large-scale poaching is ever present. Ecotourism is the most obvious and least controversial use of rhino. It offers benefits such as job and wealth creation to local communities as well as to rhino conservation. Ecotourism can only assist in conservation of the natural environment if it provides some benefits, tangible or otherwise, for the local people who are in a position to protect that environment (Buckley 2003).

The IUCN/SSC African Rhino Specialist Group (AfRSG) rates the Kunene black rhino population as a Key 1 population due to the fact that the population represents the largest free ranging desert ecotype population in the world. The population is also the only viable black rhino population worldwide to have survived on communal land lacking any formal conservation status. The population serves as a strategic flagship resource both for the conservation of biological diversity and for improving livelihoods through ecotourism. The Kunene region is the perfect area where the benefits from the increasing tourist market can be realized, due to the low human density and a unique, scenic landscape.

This population is, however, also vulnerable to forms of human disturbance that negatively impact on rhino behaviour and which could be detrimental to the population as a whole. The conservation of black rhinos is based on the need to prevent extinction due to human-induced changes and to maintain the evolutionary potential of the species (Du Preez 2000).

According to Newsome, Dowling & Moore (2002) there are two streams of thought regarding the environment-tourism relationship. The first stream of thought is that the natural environment is harmed by tourism and the second that the two have the potential to work together in a symbiotic manner where each adds to the other. Both of these points of view can be adopted and defended but the way to increase the compatibility of the two stances is to understand, plan and manage that which is grounded in environmental concepts, and to allow simultaneously for compatible sustainable development. The only means to achieve this is the protection of environmental quality by protecting the environment and yet have the realisation of the potential of tourism.

The main question that stemmed from the literature was how to identify the reciprocal impacts between ecotourism in a pristine natural environment, such as the Kunene region in Namibia, and an important flagship species, such as the black rhino.

6.3 Human-induced disturbance of black rhino

The hypothesis tested was that sustainable ecotourism has a detrimental influence on the spatial behaviour of black rhinos. Black rhino behaviour and responses to the presence of human activities were taken into consideration in order to attempt to prove or disprove the prediction hypothesis. The effects of human-induced disturbance on spatial movement patterns of black rhinos in the Palmwag Concession Area and the Torra and #Khoadi-//Hoas Conservancies were therefore investigated.

6.3.1 Effects of human-induced disturbance on spatial movement patterns of black rhinos

Results indicate that 65% of the observed black rhinos changed their normal behaviour and only 23% returned to unaware behaviour after being disturbed. Observer noise caused displacement on 75% of the observations and the reaction during observation was to run away (61%), which was deemed the most extreme reaction to disturbance. The results raised a number statistical hypotheses about black rhino behaviour. Analysis of black rhino behaviour also indicated that initial behaviour does determine a change in behaviour. Black rhinos were more easily disturbed when their activities included lying down or standing and they were less likely to be disturbed when they were walking or browsing. There was no significant difference with regard to group composition or the presence of other animals in relation to a change in behaviour.

Finally, the influence that human presence might have on black rhinos was analysed. Results from observer group size were inconclusive due to insufficient variation in numbers. Observer group size remained similar throughout the study period. The cause of displacement was also inconclusive, due to most of the observations taking place downwind of the rhino. The results did indicate, however, that most disturbances occurred early in observations and animals returned to unaware behaviour as time passed. The reaction towards human presence was measured, but no significant difference in reaction could be determined among animals that were displaced.

6.3.2. Human-induced disturbance of black rhinos in study sites

The results indicate that there was no statistically significant change in behaviour between the study sites. There were differences in the distance at which rhinos became aware of observers and at which they were displaced. Exponential trends indicated that there was a 14% rate of increase in the distance when rhinos became aware of observers and the distance at which rhino were displaced increased at a rate of 16% between the study sites. The Springbok River emerged as the study site with the most aware rhinos and those most easily displaced. The reaction of rhinos to disturbance, however, proved that the Springbok River and Aub/Barab populations had the most severe reaction to disturbance. This was measured in terms of number of animals displaced by running away and the distance they were displaced. Poacher's Camp had the least severe reaction and the Klip River results were deemed to be insignificant due to the small number of animals studied. The final measure of disturbance was the ranging pattern differences of the respective study areas. There was a definite difference in home ranges between the study areas. The differences were caused by a combination of human and environmental factors.

The conclusion with regard to the hypothesis that sustainable ecotourism has a detrimental influence on the spatial behaviour of the black rhino was accepted. Rhinos in this study were easily disturbed and did not readily return to undisturbed behaviour. Their response to disturbance was to run away, which was the greatest level of disturbance. Their disturbance was determined by their initial activity when found and the majority of disturbances occurred early in observations. Rhinos had similar causes of disturbance throughout the study sites. The Springbok River emerged as the area with the most severe reactions to disturbance. This was supported by the home ranges of the rhinos and ecological constraints.

6.4 Contribution of black rhino tracking to sustainable community-based ecotourism

Rhinos were an important catalyst in attracting donor funds to the CBNRM programme in Namibia (Spenceley & Barnes 2005). The hypothesis tested was that tracking of black rhinos contributes beneficially to sustainable community-based ecotourism. This hypothesis was tested through the use of tourist questionnaires. The literature study emphasised the CBNRM programme in Namibia and its resultant conversion of large tracts of land for wildlife and tourism.

6.4.1 Perception of tourists on tracking black rhinos

The respondent profile indicated that the majority of respondents were foreign tourists, specifically from the EU and they were visiting the country for the first time. The intended stay in the Kunene region was substantially shorter than the stay in the country, which indicated that the majority of respondents were on safari tours through Namibia. The main reasons for visiting Namibia and the Kunene region were for wildlife and a safari experience followed by the unique scenery and landscape. An important attraction to the Kunene region were rhinos which 20% of respondents specified as their reason for visiting.

Results from respondents who have not conducted black rhino tracking tourism before indicate that the majority of tourists to the area have not taken part in this activity and that the majority would want to. There was no significant difference between nationalities of respondents with regard to the tracking distance that they deemed feasible and which they were willing to walk. The research indicated that there was a significant difference in the attitude towards approach distances from the rhino between nationalities, which could indicate naivety on the part of foreign tourists. Results from respondents who have conducted black rhino tracking tourism before indicated that the minority of tourists to the area have participated in this activity before and the majority of these were taking part in the activity for the first time. The tracking time and perceived distance to the rhino varied significantly among respondents with the majority being satisfied with a distance between 25 to 200 m to the animal. There was no distance to the rhino that was unsatisfactory.

6.4.2 The black rhino as a high-value species

Spenceley & Barnes (2005) found in surveys of tourists in South Africa and Namibia that 7 to 14% of total wildlife viewing value can be ascribed to rhinos. The rhinos of the Kunene region are an important population in conservation terms and they contribute significantly to potential visitors to the area. Rhinos are very important to the area in providing jobs in tourism lodges and camps for visiting tourists (Hearn 2003).

Finally, the value that black rhinos hold for ecotourism was analysed through the attractiveness of rhino-tracking to tourists and the monetary value of the activity. The only significant factor in the decision of tourists to return was their level of satisfaction with the tracking experience. The distance between them and the rhino was the motivating factor in this decision. The analysis of monetary value of black rhino tracking indicated that tourists were willing to pay an amount of US$107 for a day's safari. Analyses of the lodges suggested that Damaraland Camp has the greatest opportunity of conducting black rhino tracking in terms of the amount of money tourists were willing to pay.

The conclusion with regard to the hypothesis that tracking of black rhino contributes beneficially to sustainable community-based ecotourism was accepted. There is a high demand for black rhino tracking. The level of satisfaction with the rhino-tracking experience of tourists was high. This was the single determining factor for tourists to return to the Kunene region to conduct rhino-tracking again. In addition, tourists were willing to pay close to the market price in regard to black rhino tracking.

6.5 Recommendations

Recognition of the impact of HID throughout the conservancy land use planning process is vital when seeking to mitigate levels of disturbance on rhino. The conservancy management plans must ensure the successful implementation of biological meta-population goals for black rhino. Resources, both financial and natural (*e.g.* access to water), should be made available in conservancies to conserve a key source of revenue – in terms of black rhino as a unique tourism product.

Research indicates that the black rhino is a flagship species that has a high monetary and aesthetic value to the Kunene region. Tracking is a way to realise this value for local communities, but tracking should be conducted according to certain guidelines:

- The Springbok River and the Aub/Barab areas should be avoided;
- Tracking must be done in the early morning;
- Rhinos should only be approached from downwind;
- Observation time should not exceed 15 minutes;
- Groups should be kept small; and
- Groups should try not to approach within 100 metres of rhinos.

6.6 Limitations of the study

The distance from Stellenbosch (academic institution) to the Kunene region in Namibia (study region) could be seen as a limitation due to lengthy and costly travelling between these destinations.

There were a number of possible limitations to the data. The main limitations are in terms of the black rhino monitoring and determining of home ranges. Black rhinos are extremely shy and secretive and gathering conclusive evidence on their home ranges proved to be problematic. The transmitters that were fitted in the horns also represent delicate equipment that can easily fail or produce weak signals. Some of the possible gaps in the data in terms of monitoring are listed below.

- A number of rhinos had weak signals and were difficult and sometimes impossible to locate. This could have been caused by shortened antennae, which reduces the range of the transmitters (Shrader & Beauchamp 2001).
- Transmitter-fitted animals could not be tracked regularly, which makes the comparisons of the distances between fixes difficult as periods between tracking

varied from days to weeks. This was mainly due to the vastness and inaccessibility of the area.

- Minimum convex polygons do not give an accurate idea of the actual area important to the animal. They give an indication of the total area that the animal may use but this tells us nothing of how the range is used (Whyte 1993, Lawson & Rodgers 1997). The researcher did not use the kernel method for determining the sizes of home ranges due to a lack of GPS points per animal.
- Radio telemetry data were only collected during daylight hours as opposed to 24-hour sampling, which could bias estimates of the utilization distribution; *i.e.* high values in areas used during diurnal periods and low values during nocturnal periods.
- The home ranges were only determined from a data collecting period of 10 months. This could be inconclusive for determining the actual home ranges. To determine home ranges, data over an extended period are needed to include factors such as seasonality, breeding cycles and droughts. Osborn (2004) states that some animals may regularly shift their ranges in response to environmental conditions and social behaviour.

Collecting questionnaires also proved to be cumbersome. The main problem areas were Grootberg Lodge and Damaraland Camp. Grootberg Lodge only had a 26% response rate, Damaraland Camp only a 10% response rate and Rhino Wilderness Camp a 34% response rate. This is in sharp contrast to Palmwag Lodge with a response rate of 74%. This could result in a misrepresentation of results in terms of Grootberg Lodge, Damaraland Camp and Rhino Wilderness Camp. The researcher was stationed at Palmwag Lodge and was able to monitor the responses to the questionnaires regularly, but was unable to do so with the other three lodges on account of the extreme distances to these locations.

6.7 Future research

Similar studies should be repeated in the near future, where results from this study are used as baseline data. Future studies could also focus on the following issues.

- The prolonged movement patterns of black rhinos in the Kunene region. Because the area is vast with a number of unknown locations, this study should be conducted over at least one year to incorporate seasonality factors determining movement.

- The long-term effects of human-induced disturbance should be evaluated for the Kunene rhino population. The long-term effects in terms of habituation, calf mortality and shifts in home range will only present themselves if research is done over an extended period of time.

- Further research into perceptions of tourists should be conducted. This would especially be applicable in the conservancy areas. A mixed method research application could benefit the outcome of research by using self-administered questionnaires and qualitative research on experiences of tourists; for example focus groups.

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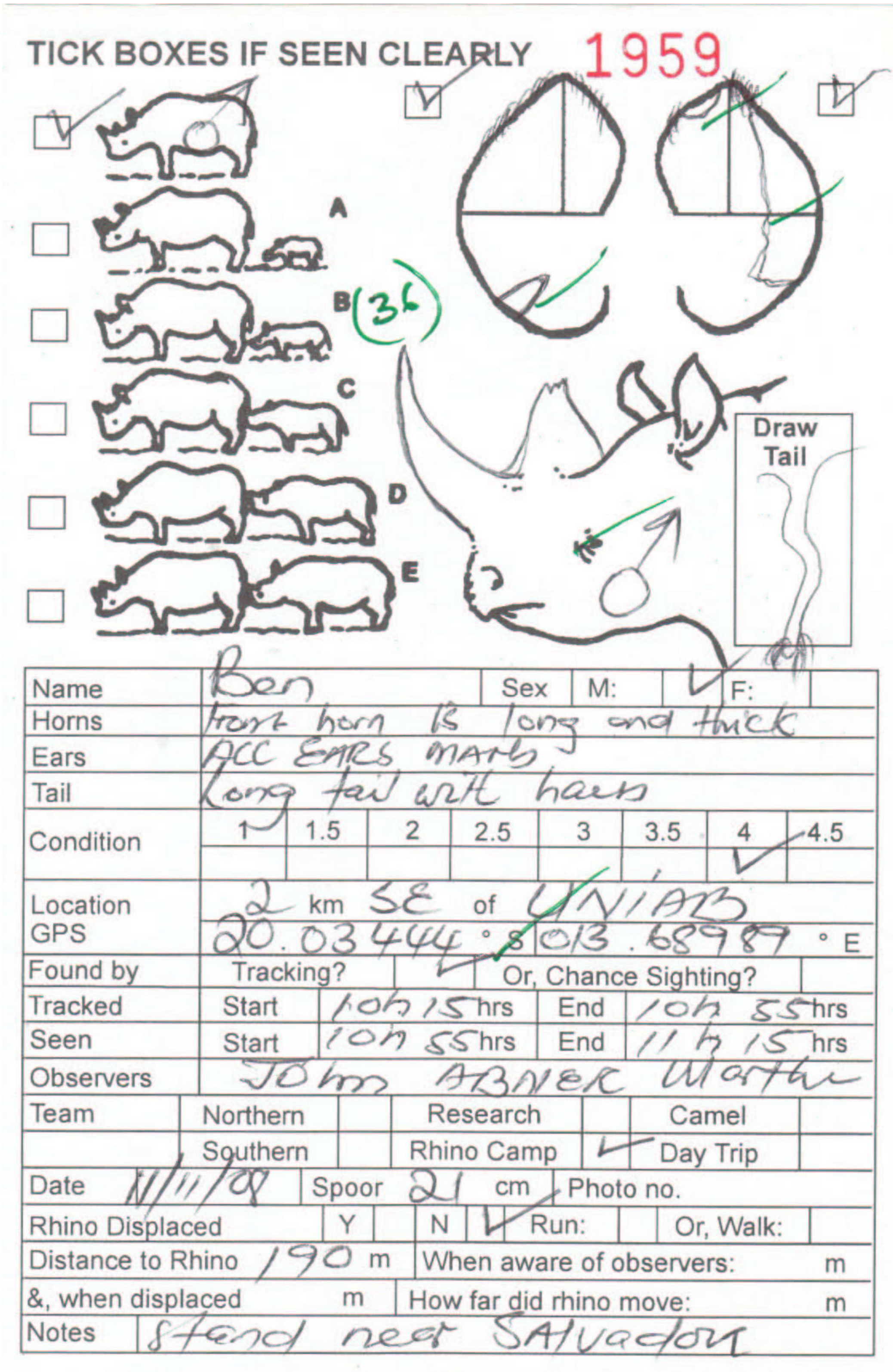
APPENDIX A: Information about the 24 black rhinos studied

Rhino	Name	Date processed	Area processed	Destination	Location	Transmitter Frequency	Sex	Estimated age
1	HO	26/03/2006	Aub River	Klip river	#Khoadi-//Hôas	149.05	Male	6
2	Zinka	27/03/2006	Aub River	Klip river	#Khoadi-//Hôas	149.80	Male	33
3	Armidillo	28/03/2006	Aub River	None	Palmwag	149.83	Male	27
4	Molly 02	28/03/2006	Aub River	None	Palmwag	149.35	Female	9
5	Molly	28/03/2006	Aub River	None	Palmwag	149.44	Female	33
6	Unknown	28/03/2006	Aub River	None	Palmwag	149.34	Female	6
7	Ernst	29/03/2006	Barab River	None	Palmwag	149.07	Male	6
8	Mamie	29/03/2006	Barab River	None	Palmwag	149.03	Female	6
9	Unknown	29/03/2006	Barab River	None	Palmwag	149.85	Male	3
10	Hi 8	29/03/2006	Barab River	None	Palmwag	149.89	Male	10
11	Verity	30/03/2006	Barab River	None	Palmwag	149.08	Female	37
12	Blacky	30/03/2006	Barab River	None	Palmwag	149.10	Male	12
13	Goliath	30/03/2006	Barab River	None	Palmwag	149.04	Male	33
14	Unknown	30/03/2006	Barab River	None	Palmwag	149.06	Male	4
15	Unknown	30/03/2006	Barab River	None	Palmwag	149.82	Female	12
16	Karonda	01/04/2006	Poacher's Camp	None	Torra	149.12	Male	33
17	Speedy	01/04/2006	Poacher's Camp	None	Torra	149.02	Male	33
18	Nane	01/04/2006	Poacher's Camp	None	Torra	149.15	Female	12
19	Tilda	01/04/2006	Poacher's Camp	None	Torra	149.17	Female	8
20	Leo	01/04/2006	Poacher's Camp	None	Torra	149.14	Male	4
21	Unknown	02/04/2006	Springbok River	None	Torra	149.20	Male	2
22	Tjeveree	02/04/2006	Springbok River	None	Torra	149.19	Female	5
23	Stompie	02/04/2006	Springbok River	None	Torra	149.36	Male	33
24	Rambuka	02/04/2006	Springbok River	None	Torra	149.32	Female	3

APPENDIX B: Save the Rhino Trust black rhino identification form



TICK BOXES IF SEEN CLEARLY 1959

A

B (36)

C

D

E

Draw Tail

Name	Ben		Sex	M: ✓		F:		
Horns	front horn is long and thick							
Ears	ACC EARS mark							
Tail	Long tail with hairs							
Condition	1	1.5	2	2.5	3	3.5	4 ✓	4.5
Location	2 km SE of UNIAB							
GPS	20.03444 °S 013.68987 °E							
Found by	Tracking? ✓		Or, Chance Sighting?					
Tracked	Start	10h15 hrs	End	10h55 hrs				
Seen	Start	10h55 hrs	End	11h15 hrs				
Observers	John ABNER Martha							
Team	Northern		Research		Camel			
	Southern		Rhino Camp	✓	Day Trip			
Date	11/11/08	Spoor	21 cm	Photo no.				
Rhino Displaced	Y		N ✓	Run:		Or, Walk:		
Distance to Rhino	190 m		When aware of observers:	m				
&, when displaced	m		How far did rhino move:	m				
Notes	Stand near Salvador							

APPENDIX C: Human-induced disturbance form

RHINO HID DATA FORM

Round River
Conservation Studies

SAVE THE RHINO TRUST

PRE-VIEWING CHARACTERISTICS

Sighting Number:			**Date:**			**Location:**		
Type of Vehicle:				**Noise level by vehicle:**		Soft	Medium	Loud
Zone:	1	2 3	4 5	6 7 8		**Purpose:**	Tourism	Patrol
Weather:	Some cloud	Sun	Overcast					
Temperature:	Hot	Warm	Cool	°C/F				
Number of Observers:	Total	Trackers	Staff	Tourists		Students		

VIEWING CHARACTERISTICS

Type of sighting:	Vehicle	Foot	**Chance Sighting?**	Yes	No	
Flushed by Vehicle?	Yes	No	**Time of Spoor Sighting:**			
Time of Rhino Sighting:			**Time from Spoor to 1st rhino location:**			
Habitat:	Riverbed	Plain	Steep slope	Gentle slope		
Vegetation:	Dwarf shrub	Shrub (<2m)	Tree (>2m)	**Vegetation Density:**	High	Low
Dominant species:			**Other Animals Present:**			
Wind Direction (Observers were...from Rhino):	Upwind		Downwind	Crosswind		
Did the wind change?	Yes	No	**GPS**	south	east	
Time of Departure			**Comments:**			

RHINO SPECIFICS

Initial Behaviour:	Lying	Standing	Walking	Browsing	Running	
Final Behaviour:	Lying	Standing	Walking	Browsing	Running	
Rhino Name:			**Other rhines:**			**Group Size:**
Composition:	Single Male		Single Female		Cow + Calf	
Rhino changed normal behaviour during observation?			Yes	No		
Rhino retured to unaware behaviour?	Yes	No				

Unaware		
Behaviour	Time	Distance

Cause of displacement:	wind change	Observer noise		
	other:			
Rhino:	Ran away	Ran toward	Walk away	Walk toward
Displcement distance:				
Comments:				

Aware		
Behaviour	Time	Distance

Displaced / Return to Unaware		
Behaviour	Time	Distance

APPENDIX D: Questionnaire for tourists

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot · your knowledge partner

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Master's (Human Geography)

Questionnaire for radio telemetry tracking of black rhinos as a possible tourism venture

The north-west Namibia (Kunene) has the largest population of black rhinos outside a protected area and this population has increased under strong partnerships between the Ministry of Environment & Tourism (MET), NGOs (Save the Rhino Trust), concessionaires (Wilderness Safaris) and the local people over the last twenty years in Kunene and Erongo Regions.

As a trial, the Ministry of Environment and Tourism has translocated two transmitter-fitted black rhino bulls to the Klip Rivier in #Khoadi-//Hoas Conservancy. A newly established joint venture between #Khoadi-//Hoas Conservancy and Grootberg Lodge will be assisted to start rhinoceros tracking safaris. Nine animals currently in Torra Conservancy have been fitted with transmitters to assist the conservancy in starting a rhinoceros tracking tourism operation. A further thirteen animals have been fitted with transmitters in the Aub/Barab Rivers in the Palmwag Concession. The aim of this survey is to determine the interest of tourists to do tracking of black rhinos on foot through the use of radio telemetry and local trackers.

Benefactors of this research include:

- Local communities: Torra and #Khoadi-//Hoas Conservancies will introduce a rhinoceros tracking tourism operation which needs to be analysed to determine the success at ground level.
- MET: The MET will gain insight into the feasibility and success of the proposed tourism project and its effects on the identified rhinos. This tourism option can be included in the tourism development plan for the "Kunene Contractual Conservation Area".
- Local tourism: Safari operators/concessionaires in the area will be able to evaluate the success of rhinoceros tracking tours where clients use telemetry and indigenous tracking skills. This tourism option can be expanded to other protected areas and conservancies where it will create valuable job opportunities for local communities.

The questionnaire is completed anonymously and will take approximately 10 minutes of your time.

<u>Section 1</u> [Please tick or write answers in space provided.]

1. Age:………..

2. Gender:…………

3. Nationality:…………………………………….

4. Have you visited Namibia before? Yes No Number of times……….

5. Have you visited north-west Namibia (Kunene) before? Yes No Number of times……….

6. Total number of days you intend to stay in Namibia (non-Namibians only)?...........days

7. Total number of days you intend to stay in north-west Namibia(Kunene)?...........days

8. What are your reasons for visiting Namibia (non-Namibians only)?

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

9. What are your reasons for visiting north-west Namibia (Kunene)?

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

10. Have you had the opportunity to track black rhino on foot in Namibia? Yes No
    (If **Yes,** please go to Section 2)

11. Would you be interested in doing black rhino tracking on foot with the use of radio telemetry and an experienced local tracker? Yes No

    If **No**, please specify alternative activity you wish to conduct.

…………………………………………………………………………………………
………………………………………………………………………………………....

12. What distance are you willing to walk while doing radio telemetry tracking of black rhino on foot? …………..km

13. What distance (metres) from the rhino would you consider appropriate/safe while tracking on foot?

25-50	
51-100	
101-200	
More than 200	

14. How much are you willing to pay to do radio telemetry tracking of black rhino in a communal conservancy for a day safari? US$..............

Section 2

15. Where and when did you do the tracking?

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

16. Was this your first time tracking black rhino on foot? Yes No

17. How long (minutes) did it take you to locate the rhino?

0-30	
31-60	
61-90	
More than 90	

18. What distance (metres) were you from the rhino?

25-50	
51-100	
101-200	
More than 200	

19. Were you satisfied with the distance to the rhino? Yes No

If **No**, please specify e.g. (wasn't close enough for photograph) or (too close, unsafe) etc.

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

20. Mark your level of satisfaction with your black rhino-tracking experience.

Very poor	
Poor	
Average	
Good	
Excellent	

21. Are you willing to return to north-west Namibia (Kunene) to do black rhino tracking on foot? Yes No

22. Will you recommend this type of tourism experience or are you of the opinion that it causes too much disturbance to the animal.

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

Any other comments!

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

Thank you for your cooperation.

Researcher:	Piet Beytell
Telephone number:	+264-61244055 (Windhoek)
	+264-67697014 (Palmwag)
E-Mail:	pbeytell@adept.co.za

APPENDIX E: Black rhino locations

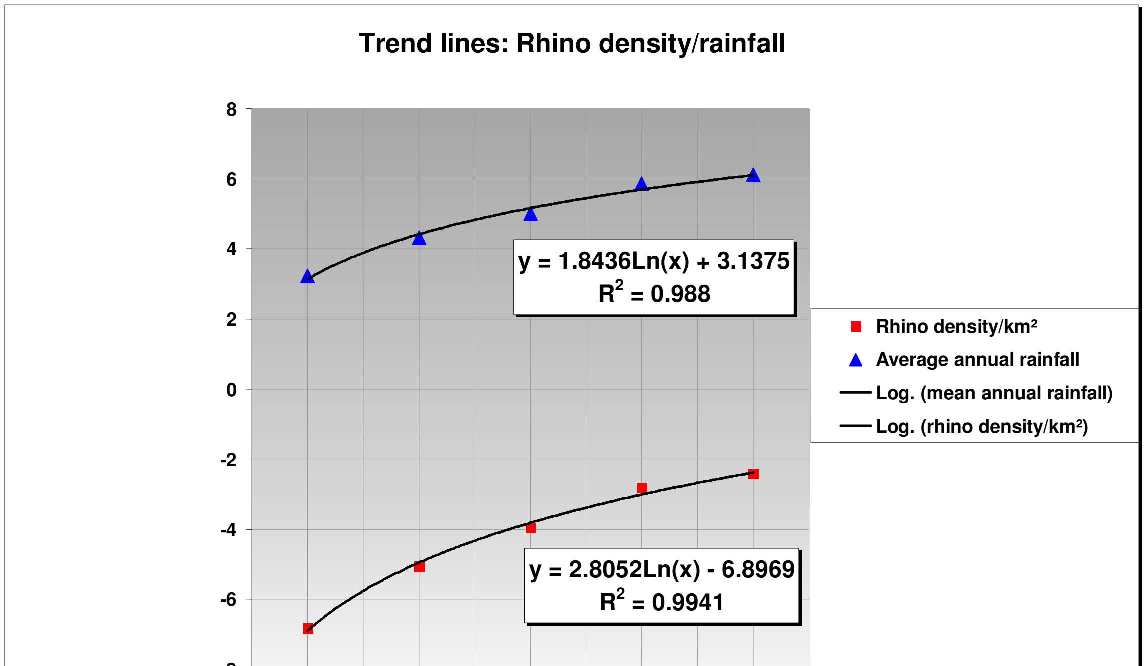
				Locations			
No.	**Name**	**Sex**	**Study area**	**Aerial**	**Ground**	**Total**	**Comment**
1	HO	Male	#Khoadi-//Hôas	7	3	10	
2	Zinka	Male	#Khoadi-//Hôas	13	4	17	
3	Armidillo	Male	Palmwag	8	5	13	
4	Molly 02	Female	Palmwag	8	4	12	
5	Molly	Female	Palmwag	7	3	10	
6	Unknown	Female	Palmwag	8	2	10	
7	Ernst	Male	Palmwag	5	1	6	Inaccessible terrain
8	Mamie	Female	Palmwag	9	3	12	
9	Unknown	Male	Palmwag	10	4	14	
10	Hi 8	Male	Palmwag	11	1	12	
11	Verity	Female	Palmwag	2	2	4	Transmitter failure
12	Blacky	Male	Palmwag	7	5	12	
13	Goliath	Male	Palmwag	12	2	14	
14	Unknown	Male	Palmwag	7	2	9	
15	Unknown	Female	Palmwag	7	3	10	
16	Karonda	Male	Torra	14	3	17	
17	Speedy	Male	Torra	14	4	18	
18	Nane	Female	Torra	13	4	17	
19	Tilda	Female	Torra	5	1	6	Transmitter failure
20	Leo	Male	Torra	11	5	16	
21	Unknown	Male	Torra	0	3	3	Transmitter failure
22	Tjeveree	Female	Torra	7	4	11	
23	Stompie	Male	Torra	13	5	18	
24	Rambuka	Female	Torra	6	4	10	

APPENDIX F: Black rhino home ranges (minimum convex polygons) in Africa

Location	Mean size (km²)
Masai Mara	13.5
Ngorongoro	42.3
Hluhluwe	5.5
Shamwari Game Reserve	13.3
Great Fish River Reserve	13.1
Pilansberg	12.0
Ndumu Game Reserve	15.6
Sable Ranch	20.0
Tswalu	40.6
Madikwe Game Reserve	22.5
Waterberg Plateau Park	55.5
Etosha National Park (West)	48.0
Damaraland	161.8

Sources: Du Preez (2000), Hearn (2003) and Adcock (2005)

APPENDIX G: Determination of estimated ecological carrying capacity



	1	2	3	4	5
Rhino density/km²	-6.818	-5.062	-3.954	-2.813	-2.408
Average annual rainfall	3.219	4.317	5.011	5.858	6.109